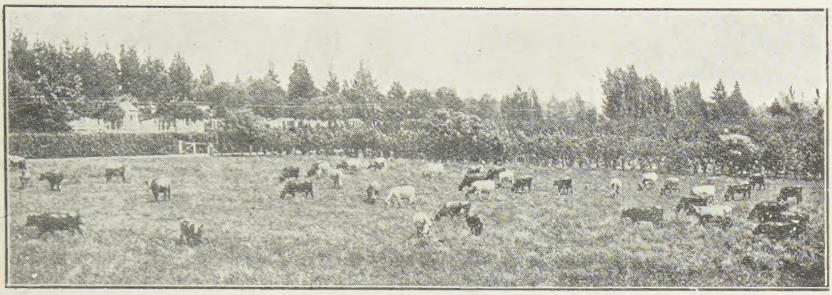

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IRRIGATION AND ITS PRACTICE.

1. THE CENTRAL OTAGO REGION AND SCHEMES.

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THE arid to semi-arid region of Central Otago extends over about 5,000 square miles, comprising the interior of the southern portion of the South Island where the Island attains its greatest width. Of this area 75 per cent. is mountainous country, not suitable for agriculture or other classes of intensive farming, but is used for sheep-grazing, being mostly held in large areas of several thousand acres each for that purpose. The remainder of the district demands only irrigation and close settlement to become one of the most highly productive districts in the Dominion.

In its early history Central Otago gained prominence and great notoriety when gold was discovered in the beds of several rivers. A rush of miners from every part of the Dominion and from other countries took place, small communities of eager gold-seekers rose up all over the country, and from being a district inhabited by only a few pastoralists, it was in a very short space of time changed into one of hustling excitement. Races necessary to convey water to sluicing claims far removed from the rivers were constructed with unwearying patience until they extended in a network of small channels all over the country.

In due course the gold boom died a natural death, and the floating population attracted to Central Otago by the gold lure gradually drifted away. A few miners living in hope or too old to break fresh trails remained on their claims, but, finding that the amount of gold procurable would barely suffice to keep them in food and clothing, were forced to augment their scanty earnings by the growth of vegetables and such produce as they required for their own use. Realizing from bitter experience the futility of depending upon the rainfall for moisture sufficient to the needs of their crops they utilized the water-races primarily designed to facilitate the extraction of gold from the soil for the purpose of conveying water to their crops in time of drought. This then, was the birth of irrigation in Central Otago.

At a later date two officers in the Public Service* were deputed to report on the possibilities of systematic irrigation in this dry region. As a result of their observations they came to the conclusion that over a quarter of a million acres of land were capable of being irrigated, and pointed out that such land if so treated would probably yield very satisfactory results. There can be no doubt that this estimate was very conservative, and it is quite safe to say that between four and five hundred thousand acres of suitable land are irrigable.

From time to time small streams have been dammed or diverted from their original course and spread over the adjacent land, with the result that the present-day traveller in Central Otago, wending his way through arid areas, meets the refreshing sight of snug orchards with trees bearing fruit comparable with the finest in the world, and comfortable farms growing a wealth of lucerne and other crops, these being the outcome of individual effort and a realization of the efficacy of applying water to the soil.

Unfortunately, it is not possible for each and every settler in the district to have an ever-flowing stream for his own private use, and consequently if no assistance were given by co-operative endeavour Central Otago would be in fifty years' time much as it was fifty years ago. During the past decade, however, considerable progress in agricultural development has taken place, and this has been the direct outcome of the application of water to the land. Facilities for doing this have been afforded by the establishment of several fairly comprehensive Government irrigation works, and numerous smaller private schemes. The amount of public money thus expended will undoubtedly prove of national benefit; but having inaugurated the irrigation works and delivered the water to the farmers it now remains to be shown how most judiciously that water may be utilized, what crops are best grown under irrigation, and the most practicable methods of applying the water to crops on different grades and types of land.

Although irrigation farming is older than any other kind of highly developed agriculture in the world, it is nevertheless a fact that the average settler in New Zealand has had no experience in its practice. Since the advent of irrigation in Central Otago people of all sorts and conditions have been coming there to take up land.

* J. L. Bruce and J. H. Dobson, "Irrigation in Central Otago," 1909.

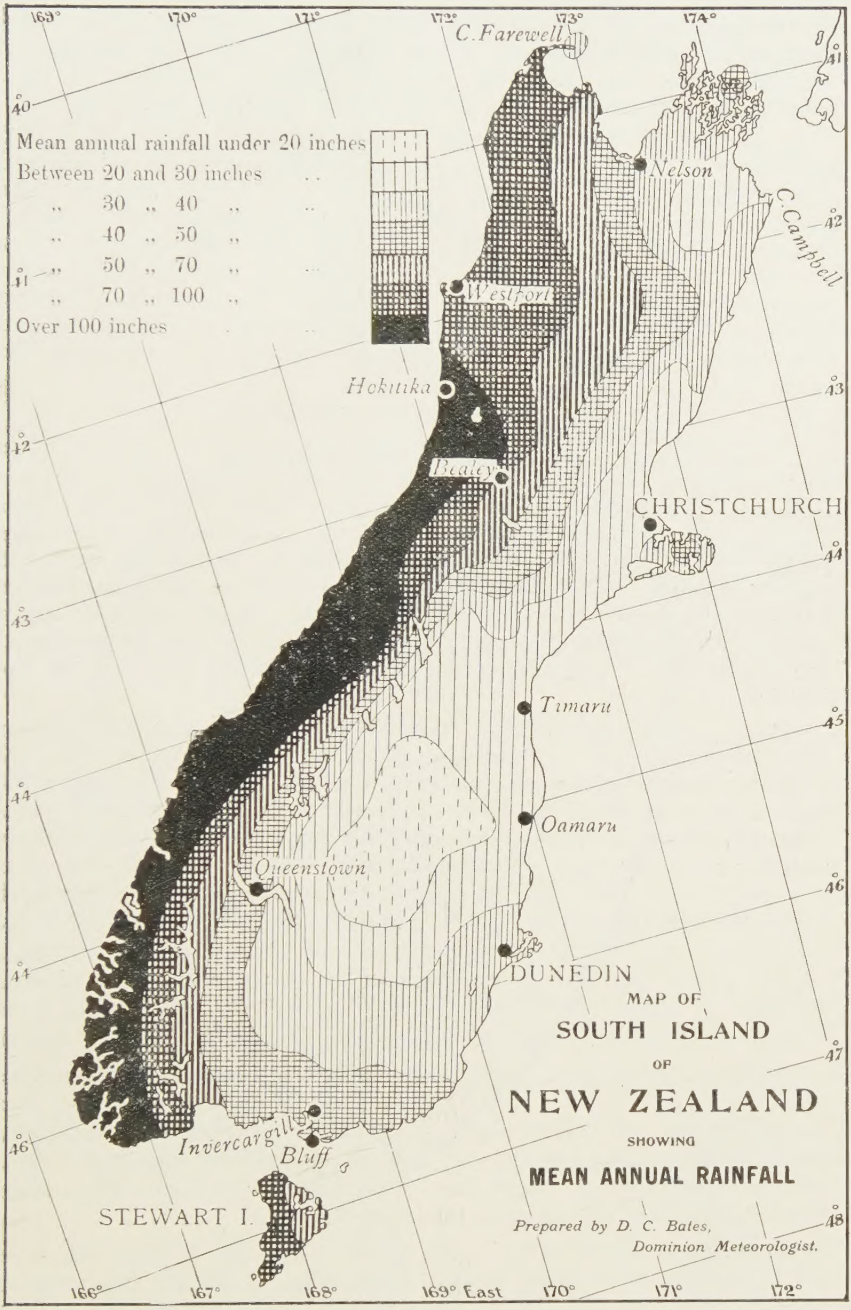


FIG. 1. SHOWING THE CENTRAL OTAGO DISTRICT ON THE LOWEST SCALE OF RAINFALL IN THE SOUTH ISLAND.

Most of them come with the purpose of making comfortable homes on the land and of earning a living by farming, but one finds among them many individuals who know little or nothing of farming, as well as those who lack the physical qualities necessary to cope successfully with the varying conditions of a settler's life.

It is not generally recognized that it takes as much capital and more agricultural skill to develop and bring into production an irrigated farm than is required to successfully farm in a humid district. The need of a fairly comprehensive series of articles dealing with irrigation in Central Otago has been felt for some time past, and with this object in view the present writers have undertaken to prepare such matter in the hope that it will be of use to irrigators, by presenting to them in simple condensed form the fundamental principles of irrigation and the practical application of those principles to their daily work on the farm.

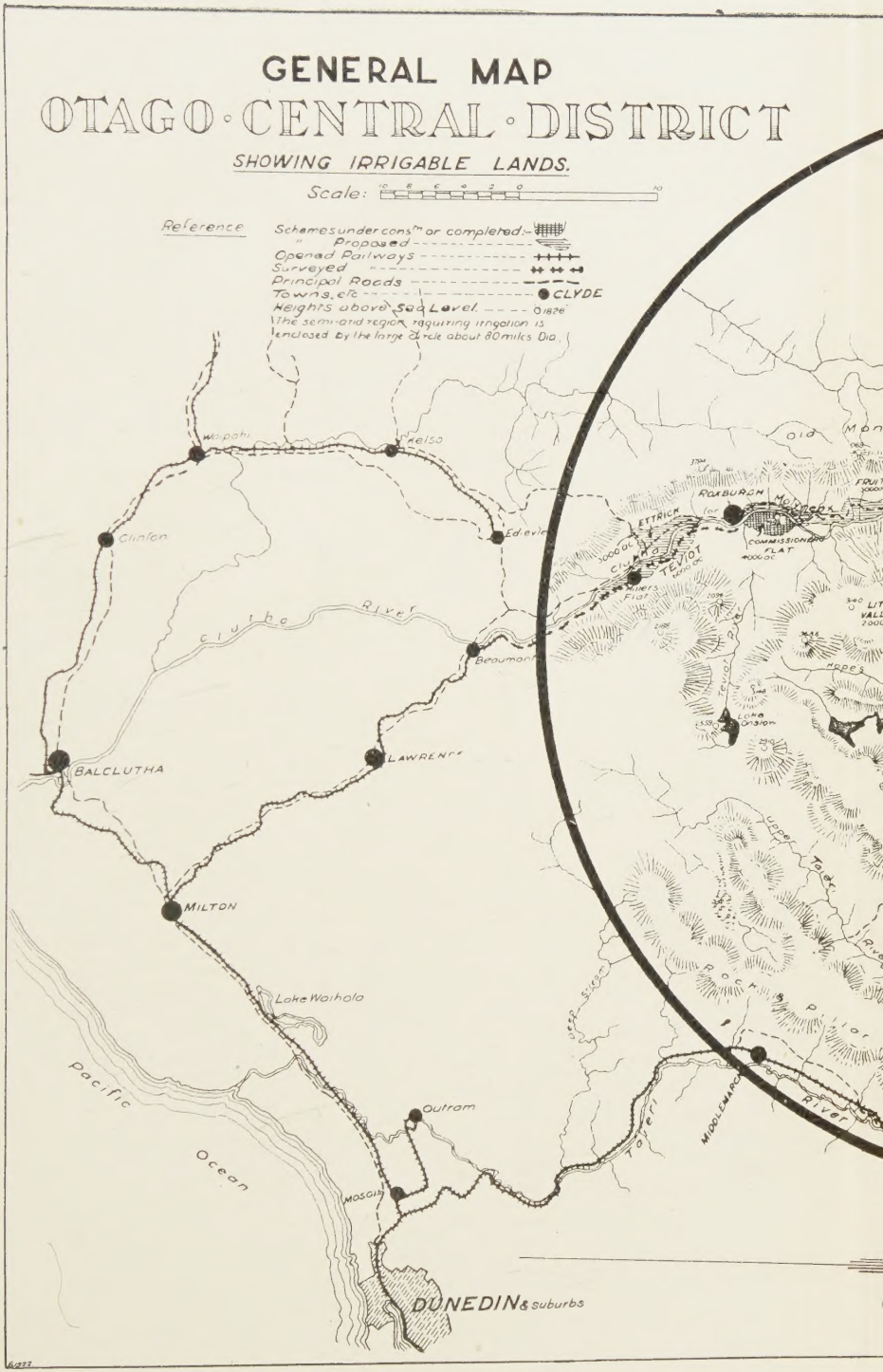
DESCRIPTION OF CENTRAL OTAGO.

A brief description of the area dealt with in this article will be of use to intending settlers, and a glance at the general map of Central Otago (Fig. 2) will serve to illustrate the chief irrigation localities. This map shows, enclosed within a circle of approximately forty miles radius, with Clyde as its centre, what might be termed the semi-arid region of Otago. The country is intersected by ranges of mountains between which are valleys rich in fertile soil. These valleys lie at an altitude varying from 500 ft. to 1,500 ft., and to this may be attributed the variations in climatic conditions which exist throughout the district.

During winter heavy falls of snow occur on the mountain ranges. This naturally conserved water, in the form of snow up on the high country, gradually becomes available for use in the valleys as the warm season approaches. Were it not for the fact that heavy falls occurred, then the difficulty of obtaining water for irrigation purposes would practically prove insurmountable. As it is each valley is traversed by a river, and in spring numerous smaller streams rush down the mountain-sides. The damming of such streams and the conservation of their water-supply is one of the problems with which the irrigation engineer is confronted; it is the regulation of such streams by dams which assures the settlers in the valleys of a continuous supply of water for their crops throughout the dry season.

Central Otago may be regarded as fairly well equipped in the matter of roads and railways. The formation of roads in this district is a comparatively easy matter, due to the presence of splendid road-forming gravel which exists everywhere, and to the natural drainage of the porous subsoil, which allows the surface of the roads to dry almost immediately after the cessation of rain.

From an economic point of view it is of interest to note that trees are practically non-existent in this region (Fig. 3), but for fuel purposes nearly every township has in close proximity deposits of lignite of a fairly good quality. Electric power and light is already being supplied to settlers in certain portions of the district, and the reticulation of other areas and townships is in progress. Lime deposits do not occur



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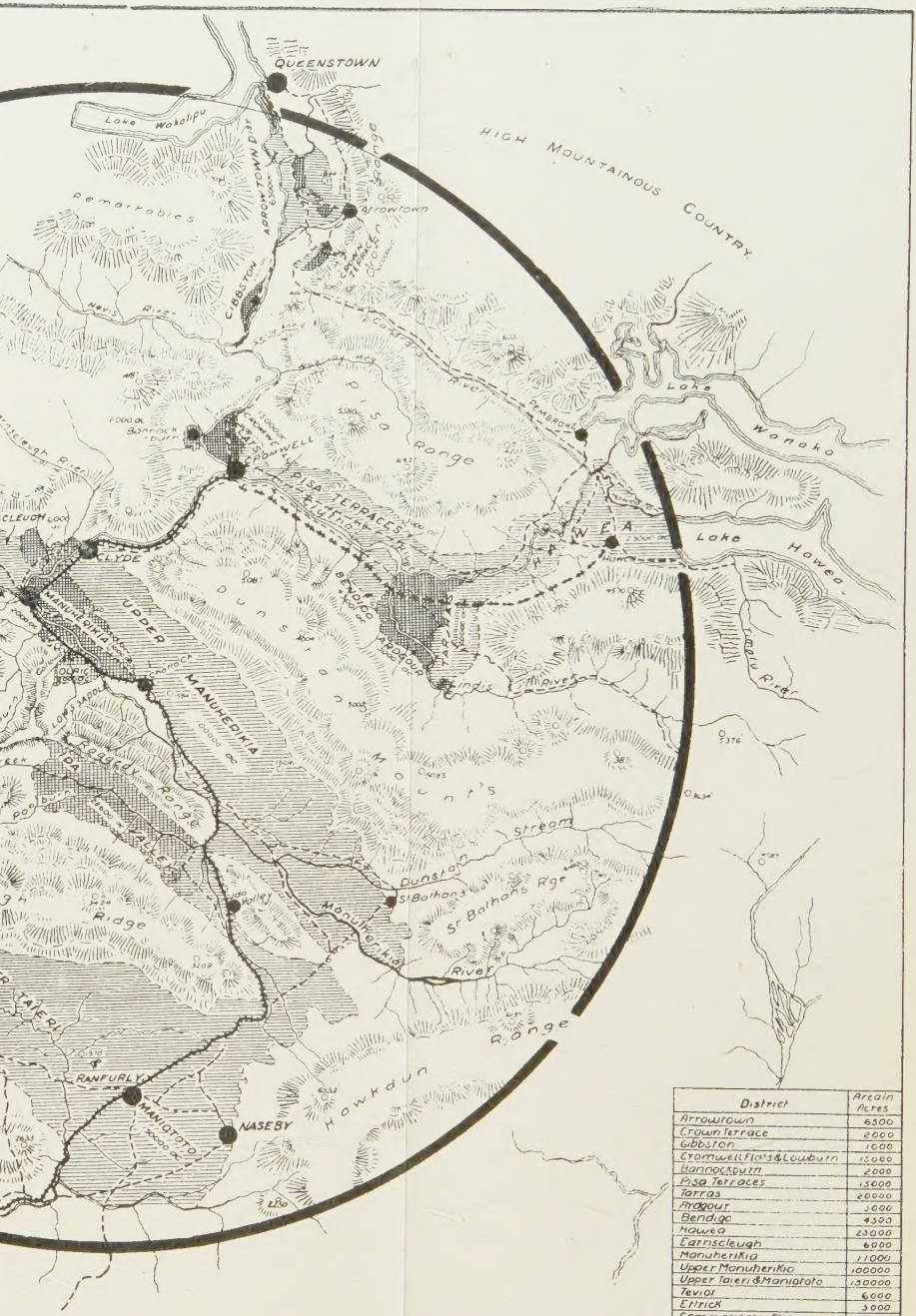

District	Area in Acres
Arrowtown	6300
Crown Terrace	2000
Gibbston	1600
Cromwell Flats & Lowburn	15000
Bannockburn	2000
Pisa Terraces	15000
Terras	20000
Ardgour	3000
Bendigo	4500
Hawea	23000
Earnscleugh	6000
Manuherikia	11000
Upper Manuherikia	100000
Upper Taieri & Maniototo	130000
Teviot	6000
Ettrick	3000
Commissioners Flat	4000
Fruitlands & Coal Creek	3000
Ida Valley	2600
Galloway	2000
Otrig	2000
Little Valley	2000

Areas given as irrigable include some lands to which water could reasonably be pumped

Total area irrigable 409600 Ac

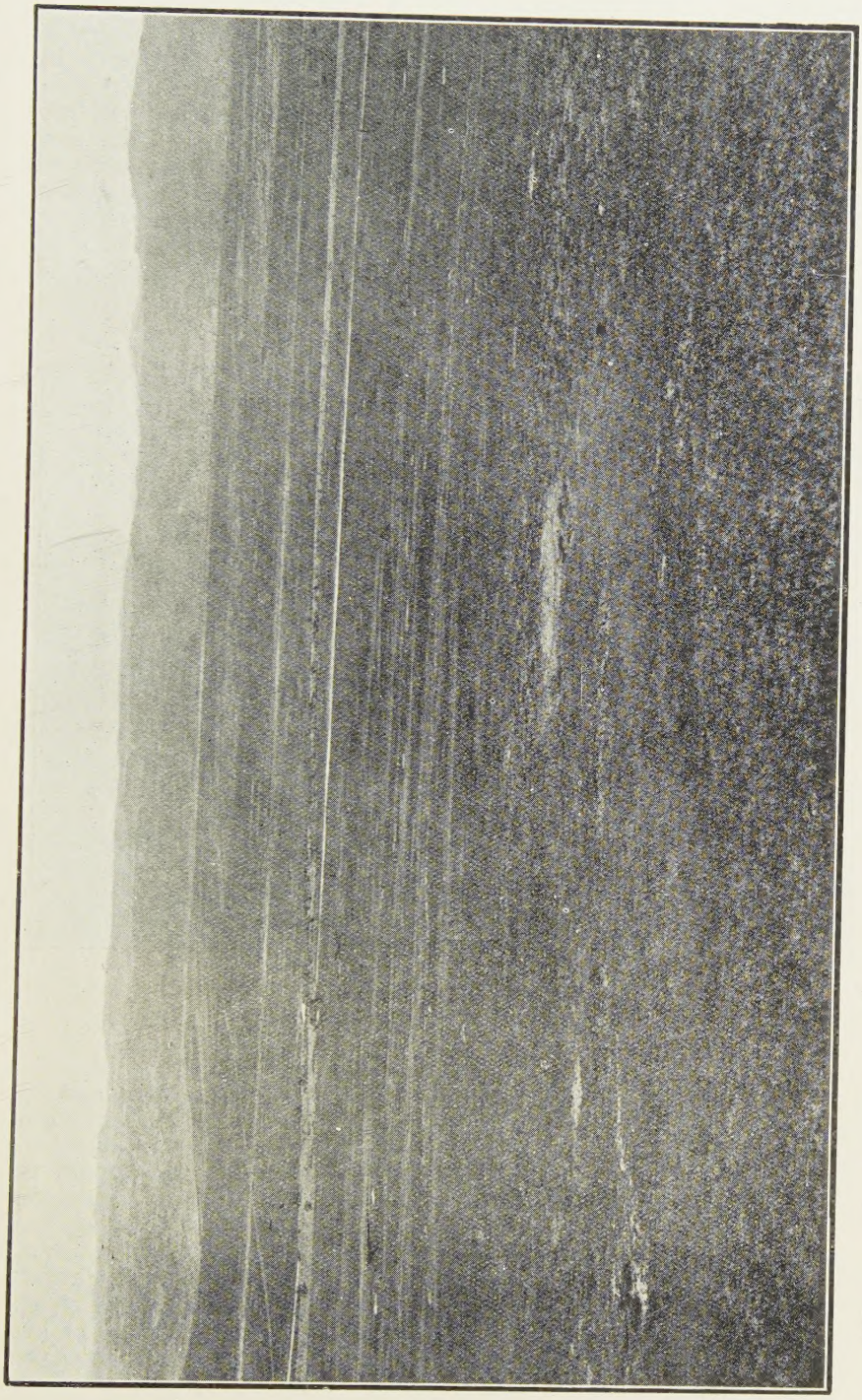

FIG. 3. VIEW OF IRRIGABLE COUNTRY IN CENTRAL OTAGO, SHOWING TREELESS CONDITION AND NEED FOR SHELTER-BELTS.

in great number, there being, as a matter of fact, a scarcity in this respect. On the side of Lake Wanaka there is a fairly large deposit of limestone of good quality, which is frequently used by farmers in the immediate neighbourhood, and there is no doubt that in the future provision will be made to enable irrigators to procure abundant supplies from this source. An interesting and important deposit also occurs at the south end of Lake Hayes (Fig. 4). Professor Park, reporting on this deposit, states that "the material is excessively fine in texture, and so soft as to be easily excavated by a spade without exercising much force. Its purity and pulverent form renders it of great economic value for agricultural purposes, both for dressing the land and in the manufacture of manures."

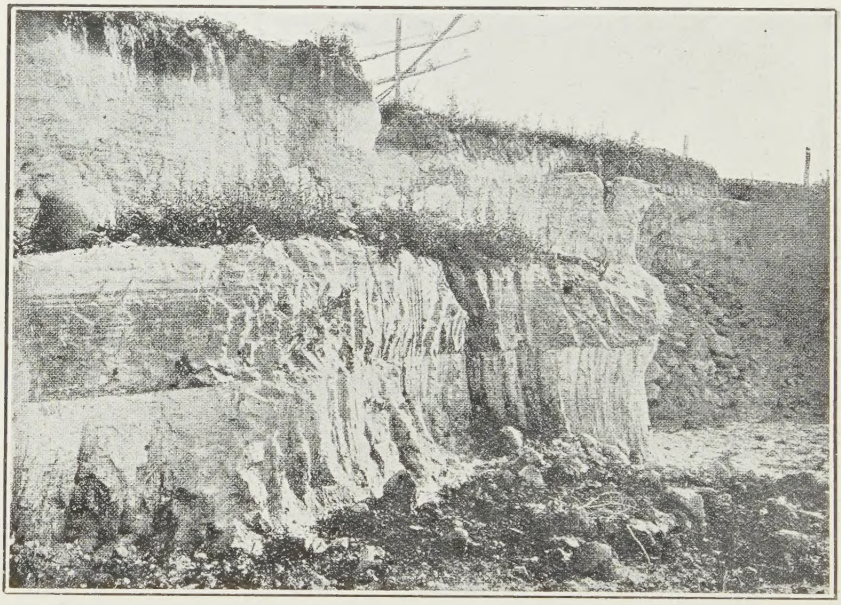

FIG. 4. LIMESTONE DEPOSIT, LAKE HAYES.

Soil Conditions.

The plains and river-terraces of Central Otago have been built up of the softer portions of the metamorphic schists, forming deep mica-schist soil which responds in a wonderful way to cultivation and irrigation (Fig. 5). The fertility of the soil is notorious, and appears to be the outcome of a happy combination of physical and chemical characteristics. Captain Hutton, F.R.S., in 1875 ("Report on the Geology of the Goldfields of Otago," page 95) stated that "the soils of Otago taken as a whole are decidedly above the average in quality, and this appears to be owing to the great extent of mica-schist exposed at the surface, the decomposition of which has supplied more or less directly almost all the soil in the province. That this schist contains a considerable amount of lime is proved by the incrustation in nearly

all the caves occurring in it; and the good quality of the soil derived is well seen in the Dunstan district, which is remarkably fertile when irrigated."

Mr. B. C. Aston, writing in the *Journal* for June last, gives it as his opinion that "the fertility of the mica-schist soils of Otago is due not to lime or potash or to the total amount of phosphoric acid they contain, but to the comparatively large amount of available phosphoric acid present, a point of great theoretical and practical importance." The fact that available phosphate is abundant in these Otago soils but deficient in most New Zealand soils, especially those of the North Island and northern parts of the South Island, suggests that some day Central Otago, with its splendid summer climate and irrigation possibilities, will become one of the finest farming districts in New Zealand.

The same writer points out that this amount of available phosphoric acid would probably equal a dressing of from 8 cwt. to 16 cwt. of phosphoric acid per acre, which would take from $2\frac{1}{2}$ tons to 5 tons of superphosphate to supply. If the computation is correct, then the marvellous results obtained from this soil are explained.

The following table (adapted from Mr. Aston's article) gives some analyses of Central Otago mica-schist soils made in the Department's Chemical Laboratory from time to time :—

Table 1.—Chemical Analyses of Central Otago Micaceous Soils.

Laboratory No.		Locality.	Vol tile Matter.		Total Nitrogen.	1-per-cent Citric-acid Extract, Dyer's Method, Hall's Modification (Available Plant-food).				Hydrochloric-acid Extract (Total Plant-food).			
			At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.
L	295	Earnscleugh ..	2·48	4·60	0·140	..	..	0·014	0·052	0·35	0·38	0·20	0·10
B	944	Cromwell ..	0·64	0·34	0·080	..	..	0·011	0·069	0·41	1·01	0·16	0·24
J	11	Alexandra ..	32·00	1·12	0·056	..	..	0·008	0·064	..	..	..	..
J	77	Maniototo ..	4·52	5·95	0·189	..	..	0·031	0·041	..	..	..	..
P	278	Composite sample	1·92	6·05	0·254	0·197	0·055	0·037	0·031	1·23	1·02	0·66	0·09

The composite sample was made up of samples of soils from Roxburgh (two), Beaumont, Naseby, Sutton, Manuherikia, Maniototo, St. Bathan's, and Frankton. This analysis supports the statement of Professor Park in Bulletin No. 2 of the Geographical Survey, that "the soil possesses a latent richness that the casual observer would hardly suspect. By the application of water the wilderness is transformed into fruitful gardens and prosperous farms. The conservation and distribution of water for irrigation purposes will in time convert the plains and valleys of Central Otago into one of the most prosperous agricultural districts in New Zealand."

While it is true that a large percentage of the soil is of first-class quality, it must be borne in mind that, like most districts, a diversity of soils exists. Thus in Ida Valley the character of the subsoil is quite different from that obtaining in the Manuherikia Valley, in that the former is of a close clay texture and the latter of a free open nature

largely intermixed with waterworn gravel. Again, cropping out from deep deposits of schist soil appear large beds of lighter gravel, in character so porous as to make the application of water to them, while in their natural state, a difficult and wasteful matter. As will be shown later, there is a very intimate relationship between these different types of soils and the methods required to irrigate them.

FIG. 5. GORGE, SHOWING MICA-SCHIST FORMATION.

The water-race seen is part of the main race of the Government Manuherikia scheme.

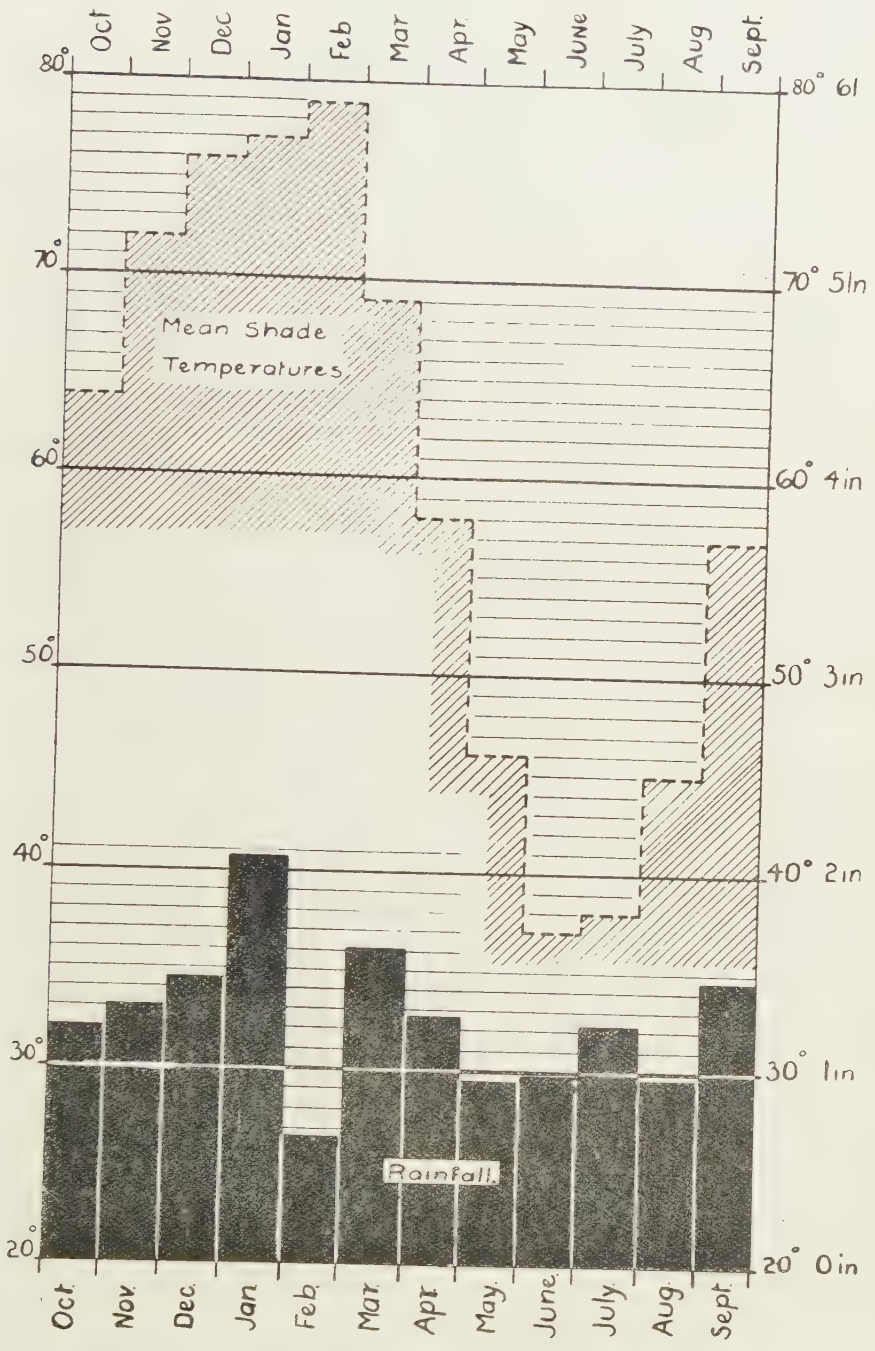

FIG. 6. GRAPH SHOWING MEAN MONTHLY SHADE-TEMPERATURE (FAHR.) AND AVERAGE MONTHLY RAINFALL FOR CENTRAL OTAGO IRRIGABLE REGION.

Temperature from two years' and rainfall from five and a half years' records.

Rainfall.

When it is borne in mind that the average rainfall over the South Island is in the vicinity of 45 in. per annum, then it will be realized that Central Otago, with an annual fall averaging slightly over 15 in. and ranging from 12 in. to 20 in. per annum, is in a most unfavourable situation insofar as rainfall is concerned. Fig. 6 illustrates in graphical form the average monthly rainfall and temperature of the irrigable lands, and demonstrates the necessity of augmenting this low summer rainfall. From this graph it will be observed that the average rainfall during the growing-period—October to March inclusive—is approximately 8·8 in., and that during the month of February the average rainfall is the lowest for the year, being approximately $\frac{2}{3}$ in. During that month, however, the highest temperatures throughout the year are recorded, and when it is borne in mind that the mean shade temperature for the whole month is 79° F. it will be understood how excessive is the heat, and consequently how great must be the evaporation of moisture from the soil. During February, therefore, more frequent irrigations must be given to growing crops.

GOVERNMENT IRRIGATION SCHEMES COMPLETED OR UNDER CONSTRUCTION.

Brief details of the Government schemes completed or under course of construction in Central Otago will be of use, and the information is given in tabulated form in the accompanying Table 2.

In the case of the Ida Valley scheme, the area is admirably adapted for dairy-farming and the raising of beef or mutton (Fig. 7). The growing of special seed crops such as clover, &c., would appear to offer good remuneration to the farmers there. On account of its height above sea-level—namely, 1,500 ft.—the conditions are not favourable for fruit-growing except in some sheltered spots. General mixed farming, and especially lucerne-growing, present great possibilities. As regards the other irrigation areas mentioned in Table 2, practically any type of farming can be successfully practised on them, but there is no doubt that intense cultivation combined with either dairy-farming, the raising of stock, or fruitgrowing will give the most satisfactory results.

In addition to the schemes already in hand the Government has also investigated an extensive tract of country in order to ascertain the feasibility or otherwise of irrigating further areas of land. As a result of such investigations it is now realized that a much greater extent of country can readily be utilized for irrigation, as shown in Table 3.

Even with the inclusion of the projects detailed in Table 3 the possibilities of irrigating further tracts of country are by no means exhausted. The district abounds in potential hydro-electric power projects capable of developing immense amounts of power, and when the industries of the Dominion warrant the harnessing of one or more of these there are very great possibilities for the use of their surplus energy for pumping irrigation water during the periods of the twenty-four hours when the demand for other purposes is low. By thus working to the convenience of the usual power-requirements of other industries it should be possible to apply power to irrigation pumping

Table 2.—Government Irrigation Schemes completed or under Construction.

Name of Scheme.	Source of Water-supply.	Minimum Natural Flow of River.	Main Canal: Maximum Capacity	Average Annual Rainfall.	Gross Area included.	Area now being irrigated	Remarks.
		Cusecs.	Cusecs	Inches.	Acres.	Acres	
Ida Valley ..	Manorburn, Poolburn, and other small streams	Practically no natural flow in summer. Supplied from winter water conserved in Manorburn Dam	100	15·39	28,000	12,000	Further conservation dams to be constructed to fully supply whole area.
Galloway ..	Ditto						
Olrig Terrace ..	.. .. ..		15	13·77	1,300	600	Completed.
Manuherikia No. 1	Manuherikia River ..		10	13·77	1,000	300	Completed.
Ardgour	Lindis River ..	77	100	14·22	11,000	3,500	Completed.
Tarras	Lindis River ..	50 (estimated)	20	21·75	2,000	2,000	Completed.
		50 (estimated)	70	21·75	7,000	400	Under construction. Conservation dam may be necessary.
Earnscleugh ..	Fraser River ..	8	20	15·80	1,000	1,100	Partially completed. Conservation dam will be eventually required.
Last Chance ..	Shingle, Gorge, and Coal Creeks	11	20	17·87	4,300	700	Under construction. Available water only sufficient for full irrigation of 2,000 acres and partial irrigation of balance.
Teviot River ..	Teviot River and Lake Onslow Dam	10 (estimated)	80	21·97	3,000	300	Under construction
Bengerburn ..	Bengerburn Creek ..	..	5	21·97	1,000	..	Under construction.
Totals ..	..	..	..	..	63,800	21,400	

Table 3.—Further Government Schemes investigated.

Name of Scheme.	Source of Water-supply.	Minimum Natural Flow of River.	Average Annual Rainfall.	Area approximately irrigable.	Remarks.
		Cusecs.*	In.	Acres.	
Cromwell Flat and Lowburn	Roaring Meg Stream	29	21·75	3,750	Also presents possibilities for hydro electric power development with water before use for irrigation.
Upper Manuherikia ..	Manuherikia and Dunstan Rivers	77	17·59	100,000	Two or three large storage dams will be necessary.
Maniototo	Taieri River ..	25	18·34	150,000	A large storage dam will require building.
Teviot River extension	Teviot River and Lake Onslow Dam	40	21·97	13,400	Lake Onslow Dam will require enlarging.
Arrow River ..	Arrow River ..	100 (estimated)	32·18	6,500	Gravity scheme.
Chapman's Gully ..	Butcher's Creek and Storage Dam	..	14·91	100	Gravity scheme.
Bendigo Flats ..	Lindis River ..	50	21·75	3,000	Gravity scheme.
Hawea Flats, first development	Timaru Creek ..	20 (estimated)	24·96	4,000	Gravity scheme.
Total ..	..	..	..	280,750	

* The term "Cusec" denotes a flow of water equivalent to 1 cubic foot per second. It is synonymous with the old mining term a "head" of water.

FIG. 7. VIEW IN IDA VALLEY.

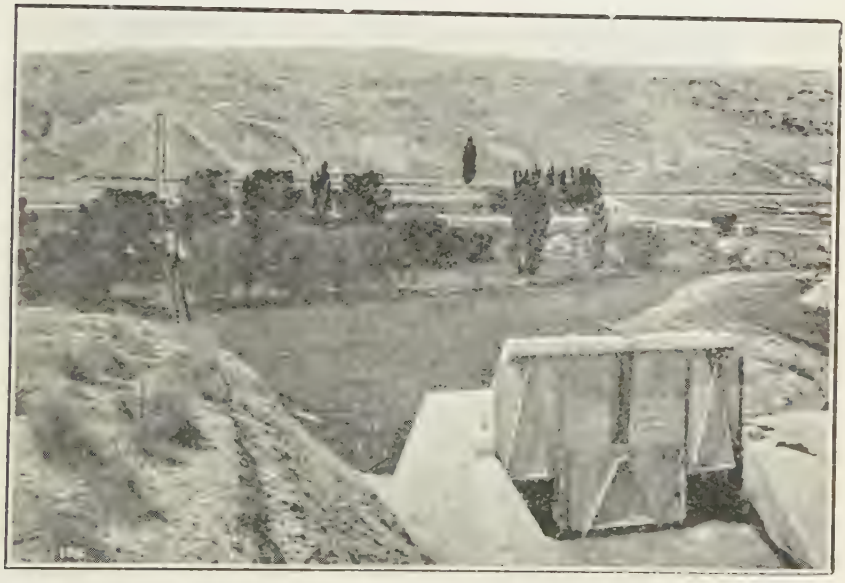

FIG. 8. SIPHONS AT CHATTO CREEK: A FEATURE IN THE MANUHERIKIA SCHEME.

Note pipe-lines carrying water across flat and over hill on other side.

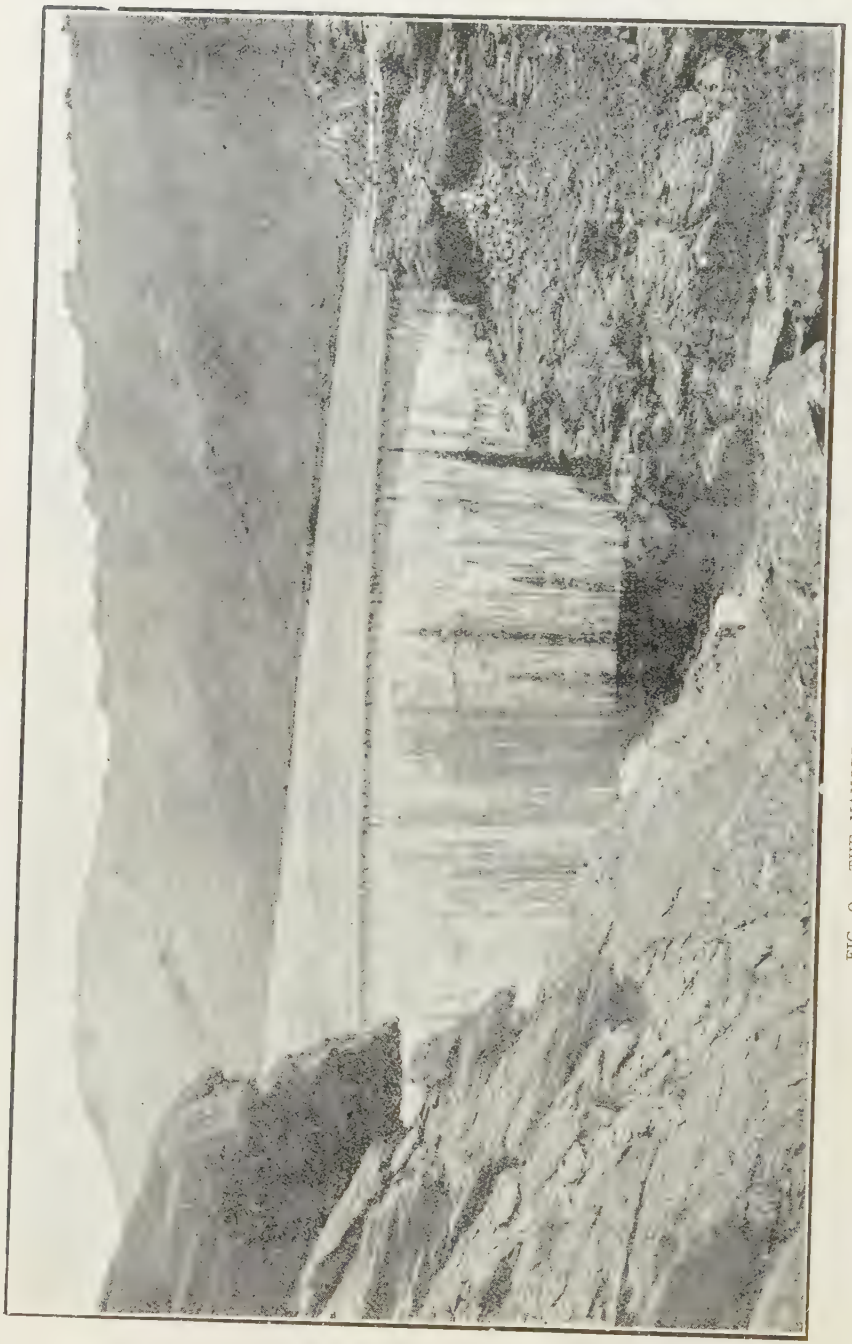

FIG. 9. THE MANORBURN DAM: IDA VALLEY SCHEME.

at low cost, while at the same time probably justifying the undertaking of such power schemes at an earlier date than might otherwise appear warranted. With cheap hydro-electric power there is no doubt that many areas not now being investigated as potential irrigation settlements, chiefly because an economic gravitational supply of water is not available, would be dealt with by pumping water from the larger rivers and lakes.

INDIVIDUAL, COMPANY, AND LOCAL-BODY UNDERTAKINGS.

Irrigation development has also been successfully carried out, or is at present in progress through individual effort, by companies, or by local bodies. Works undertaken by individual effort comprise a hundred or more small areas scattered throughout the district, generally in the most favourable situations, which involve a minimum of construction cost. There are, however, a few instances where more enterprising settlers have confidently and successfully constructed irrigation works of considerable magnitude, involving in some instances the loading of their farms with construction costs running into several thousands of pounds. Among the most notable of these individual irrigation undertakings are those of Mr. John Wilson, at Lauder; Mr. P. R. Sargood, at Wanaka; Mr. Lee, at Lake Hayes; Mr. Lethbridge, at Ardgour; and Mr. R. K. Smith, at Tarras. The last-mentioned undertaking has recently been acquired by the Crown for enlargement and extension. The total area of lands under irrigation by individual effort is estimated by the writers at 10,000 acres.

There are only two instances of companies being formed to construct irrigation works—namely, the Little Valley development party and the Cromwell Development Company. The former have acquired

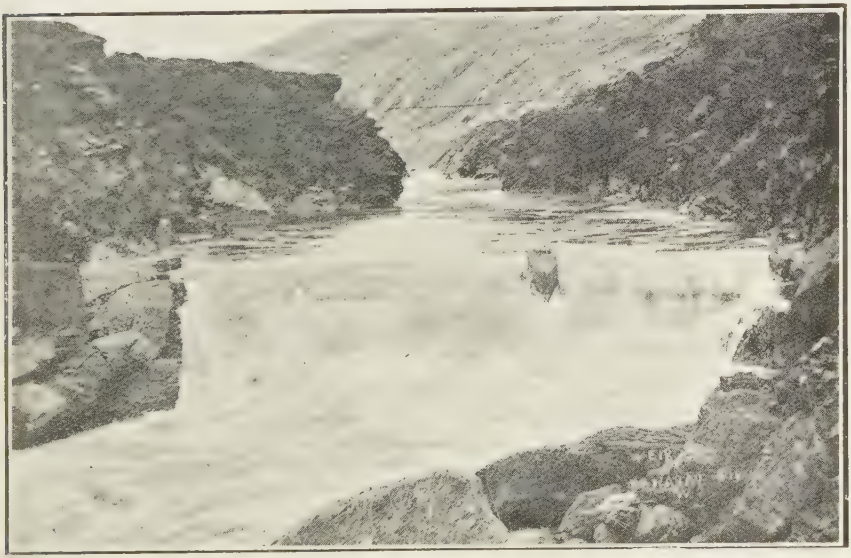

FIG. 10. KAWARAU RIVER, SHOWING CROMWELL DEVELOPMENT COMPANY'S WEIR.

FIG. 11. THE CROMWELL DEVELOPMENT COMPANY'S RIPPONVALE SETTLEMENT.

abandoned mining water-races and are developing them with a view to irrigating 1,000 acres of land. The Cromwell Development Company has undertaken and practically completed works of very considerable magnitude and of a most interesting nature which will provide irrigation for probably 4,000 acres or more (Figs. 10 and 11).

There are three local-body schemes, all under the Vincent County Council—namely, Bannockburn (about 1,700 acres), Matakanui (about 5,000 acres), and Blackman's (about 1,000 acres). The two former are in a state of development, only about half of the areas being yet supplied with water, while the last-named has been in full operation for many years.

SUMMARY OF IRRIGABLE AREAS.

The following table gives a summary of all the areas in Central Otago capable of irrigation by gravitation and pumping methods.

Table 4.—Summary of all Irrigable Areas.

——	Area actually under Irrigation at 30th January, 1924.	Works under Construction—mostly expected to be completed during 1924.	Areas investigated and considered Feasible for Development by Gravitational Water-supply.	Further Areas estimated as probably irrigable when Cheap Power available for Pumping.	Totals.
	Acres.	Acres.	Acres.	Acres.	Acres.
Government	21,400	42,400	280,750	42,350	386,900
Individual	10,000	..	..	..	10,000
Company ..	..	5,000	..	..	5,000
Local body	4,350	3,350	..	..	7,700
Totals	35,750	50,750	280,750	42,350	409,600

(To be continued.)

INTRODUCTION OF SHEEP INTO NEW ZEALAND.

RECORD OF FIRST ENTRY OF EACH BREED.

J. G. COOK, Live-stock Division, Wellington.

It is generally admitted that insufficient attention has been given in the past to the compiling of records of different matters connected with the earlier history of British settlement in New Zealand. Among such matters may be included that of the introduction of live-stock.

The information tabulated below represents an endeavour to supply the deficiency as regards the first introduction of various sheep-breeds into this country. Although the compilation is the result of considerable research it is not as complete in detail as could be wished, and the writer will welcome any information enabling missing particulars to be filled in. Needless to say, it is highly desirable that complete and authentic records, covering this and related matters in the agricultural history of the Dominion, should be held by the Department of Agriculture.

It may be mentioned that several of the breeds represented in the list have not been maintained in New Zealand since their introduction. So far as can be ascertained the following breeds have been dropped: Dartmoor, Roscommon, Scotch Blackface, Norfolk Down, Cotswold, Tunis, and Bharal. Several other breeds—namely, Dorset Horn, Hampshire Down, Oxford Down, South Devon, and Wensleydale—are present in very small numbers only.

FIRST INTRODUCTIONS OF SHEEP-BREEDS INTO NEW ZEALAND.

Breed.	Date of Arrival.	Animals.	Introduced by	Province.	Breeder.	Introduced from
Merino ..	18th-22nd May, 1773 (ship "Resolution")	1 ram, 1 ewe	Capt. James Cook	Marlborough	..	Cape Colony.
" ..	23rd Dec., 1814 (ship "Active")	..	Rev. S. Marsden	Auckland ..	Rev. S. Marsden	New South Wales.
" ..	4th May, 1842 (ship "Jupiter")	..	Capt. W. King	Taranaki ..	..	New South Wales.
Southdown ..	23rd Feb., 1842 (ship "Timandra")	2 rams, 10 ewes	Mr. Devenish	Taranaki ..	Mr. Briscoe..	Dorset.
English Leicester	28th Sept., 1843 (ship "Tyne")	1 ram ..	A. Saunders	Nelson ..	J. Arnold ..	Somerset.
Cheviot ..	26th Jan., 1845 (ship "Slains Castle")	1 ram, 1 ewe	Mr. Mackay	Nelson ..	..	..
Romney Marsh	2nd Sept., 1853 (ship "Cornwall")	4 rams, 16 ewes	L. Young ..	Wellington	Jeremiah Solomon	Northfleet, Kent.

FIRST INTRODUCTIONS OF SHEEP-BREEDS—*continued.*

Breed.	Date of Arrival.	Animals.	Introduced by	Province.	Breeder.	Introduced from
Border Leicester	1859 (ship "Cheviot")	1 ram, 9 ewes	New Zealand and Australian Land Company	Otago ..	1 ram and 3 ewes, Mr. Melvin, Bonnington; 6 ewes from Duke of Buccleuch	Dalkeith, Scotland.
Lincoln ..	1860.. ..	..	Esson Bros.	Wellington	..	Lincolnshire.
Cotswold ..	Oct., 1863 (ship "Gothenberg")	4 rams ..	..	Canterbury	..	..
Hampshire Down	Oct., 1863 (ship "Gothenberg")	5 rams ..	..	Canterbury	..	..
Dartmoor* ..	5th June, 1864	5 rams, 6 ewes	C. Reid ..	Canterbury	..	Devonshire.
Shropshire Down	1867.. ..	1 ram, 3 ewes	C. Williams..	Canterbury	..	England.
Norfolk Down ..	1868.. ..	..	W. Wilson ..	Canterbury	.	..
Alpaca* ..	9th Nov., 1872	1 ram, 1 ewe	R. H. Rhodes	Canterbury	.	..
Wensleydale ..	4th April, 1894	1 ram, 2 ewes	W. B. Clarkson	Canterbury	1 ram, Mr. Hodgen; 2 ewes, W. Trotter	Yorkshire.
Dorset Horn ..	25th Oct., 1897	1 ram, 2 ewes	W. Ullyett ..	Canterbury	.	..
Kent	25th Oct., 1897	2 rams ..	J. B. Logan	..	..	Kent.
Tunis* ..	24th Oct., 1900	2 rams, 6 ewes	H. Harrowell	Auckland ..	..	Tunis.
Ryeland ..	6th May, 1901	2 rams ..	Dalgety and Co.	Canterbury	..	Herefordshire.
,, ..	30th Dec., 1901	2 rams, 5 ewes	W. P. Kellock	Canterbury	..	Herefordshire.
Oxford Down ..	July, 1904 ..	1 ram, 5 ewes	J. Withell ..	Canterbury	Ram, F. Bonner Barling; ewes, C. Watkins	Herefordshire.
Roscommon* ..	1904.. ..	4 rams, 10 ewes	J. Davies ..	Wellington	Various ..	Ireland.
South Devon ..	5th Dec., 1907	1 ram, 16 ewes	W. J. Birch..	Wellington	W. Tippet and E. Stokes	Devonshire.
,, ..	1907.. ..	1 ram, 12 ewes	Chambers Bros.	Hawke's Bay	Various ..	Ditto.
Bharal* ..	30th July, 1908	2 rams, 2 ewes	N.Z. Tourist Department	Finally liberated in Canterbury	Mr. Jamrach	Kuin Lun Mountains (Himalaya), Tibet.

* Only importation of this breed.

FIRST INTRODUCTIONS OF SHEEP-BREEDS—*continued.*

Breed.	Date of Arrival.	Animals.	Introduced by	Province.	Breeder.	Introduced from
Scotch Blackface*	19th Aug., 1908	2 rams, 4 ewes	Mrs. Townsend	..	..	..
Suffolk Down ..	23rd Dec., 1913	1 ram, 6 ewes	G. Gould ..	Canterbury	1 ram and 2 ewes, S. R. Sherwood; 4 ewes, Chivers and Sons	England.
Dorset Down ..	7th Nov., 1921	2 rams, 5 ewes	J. C. N. Grigg	Canterbury	T. R. Spiller	Dorset.

* Only importation of this breed.

THE MEALY-BUG PEST IN ORCHARDS.

CONTROL BY CRYPTOLAEMUS LADYBIRD.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

THE matter of the control of mealy bugs in orchards in certain parts of New Zealand has been attracting considerable attention among those interested. Owing to the nature of the insect and its habit of frequenting out-of-the-way places such as bud-scales, beneath bark, in crevices, in the calyx and stalk end of fruit, &c., present spraying methods are not an effective means of control. Control by beneficial insects has therefore been looked to as a possible means of overcoming the difficulty, and the work of establishing in New Zealand the ladybird beetle *Cryptolaemus montrouzieri* Muls. has been put under way for this purpose.

The female mealy bug is wingless, and characterized by a white mealy covering, though the insect itself is pinkish in colour. Further, the body is fringed with short leg-like appendages, the end ones in some species being long and tail-like. These appendages have nothing to do with locomotion, the three pairs of legs being situated on the underside just behind the head. The insect moves about fairly rapidly from one part of a host-plant to another, and where it settles punctures the tissues and sucks up the sap through its proboscis. The male insect at an early stage becomes different from the female: it constructs a narrow white cocoon in some out-of-the-way place and there transforms, loosing its mouth-parts but developing a pair of wings and a pair of long tail-like appendages. When egg-laying commences the mature female constructs a woolly egg-sac, in the meshes of which the small yellowish eggs are entangled. When all the eggs have been deposited the sac may be larger than the parent itself. It frequently happens that the female will leave the host-plant in order to lay her eggs, and in consequence the egg-masses may occur in any convenient and sheltered crevice.

FIG. 1. CRYPTOLAEMUS MONTROUZIERI LADYBIRD BEETLE. MAGNIFIED 7 DIAMETERS.

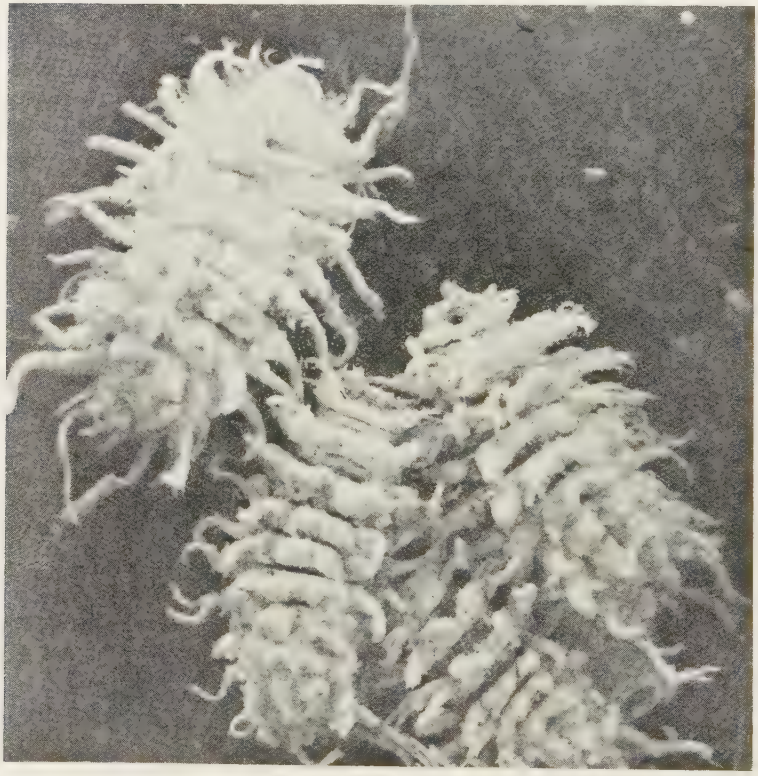

FIG 2. LARVÆ OF C. MONTROUZIERI. MAGNIFIED 7 DIAMETERS.
At this stage the parasite feeds on the mealy bug.

[*Photos by H. Drake.*

There are several species of mealy bugs in New Zealand. Two—Baker's mealy bug (*Pseudococcus maritimus* Erh.) and Comstock's mealy bug (*P. comstocki* Kuw.)—are commonly found, but the host-plants are varied.

The ladybird *Cryptolaemus montrouzieri* is a native of Australia, and has been imported into California and other countries for the purpose of combating mealy bugs. The beetle itself measures about $\frac{1}{16}$ in. long (Fig. 1) and is easily recognized by its colour-pattern, both ends of the blackish body being orange-yellow. The eggs are laid in the egg-masses of the mealy bug; from two to three weeks later the beetle-larvæ hatch, and feed on the mealy bugs. These larvæ are very like the female mealy bug in general appearance, being white and having numerous leg-like appendages projecting from the body (Fig. 2). The larva becomes fully grown in about four or five weeks and seeks out some convenient crevice, where it transforms to the pupa, retaining the old larval skin as a covering. About a fortnight later the beetle emerges. The period taken to develop from egg to adult varies with conditions of temperature and moisture, the mealy bug, also, being similarly affected.

As early as 1897 an attempt was made by the Department of Agriculture to establish this ladybird in New Zealand, numbers having been liberated in the North Island, particularly in the Auckland District. For a time no good results were noticed, but in 1901 it was reported that mealy bugs—except in glasshouses—were under control. The reports on this attempt to introduce the ladybird are, however, of too meagre a nature to base any conclusions upon. Of recent years the beetle has become uncommon in the North Island. It was introduced into Canterbury shortly after 1900 to combat the gum-tree scale, but did not survive.

Last August a consignment of the ladybirds was received from Mr. W. B. Gurney, Government Entomologist, New South Wales, and from this lot a colony was started at the Biological Laboratory. A second consignment arrived during December, so that sufficient material became available for distribution in small quantities. A third consignment including two other species of mealy bug natural enemies (*Scymnus binaevatus* and *Leptomastix abnormis*), which arrived at this Laboratory on 16th February, was sent from California through the kindness of Professor H. S. Smith and Dr. H. M. Armitage.

The method of rearing the ladybirds here is much the same as that adopted by the California Department of Agriculture, at Sacramento. Mealy bugs are bred upon sprouted potatoes, and small shallow boxes containing the latter, heavily infested, are placed in the breeding-cages with the ladybirds. As soon as adults emerge from pupæ they are transferred to a separate cage and another brood started.

Threshing-machines.—When threshing or chaff-cutting it is important to stipulate that the machine shall be thoroughly cleaned of all weed-seeds before it comes on to the farm. Weed-infected screenings should be burnt before there is a chance of their being spread.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

VIII. THE PIGEON, KIWIS, RAILS, AND SHORE-BIRDS.

J. G. MYERS and ESMOND ATKINSON, Biological Laboratory, Wellington.

THE PIGEON.

THAT family of the order of pigeons which includes the fruit-pigeons contains no more beautiful birds, even among its numerous tropical members, than the New Zealand pigeon, sometimes known by its onomatopœic name of "kuku" or "kereru." No description of its magnificent plumage, with the coppery purple of the back and the metallic green of the breast set off by the pure-white underparts, nor of the unmistakable clap-trap of its wings in flight should be necessary to New Zealand readers, although it is too true that there are large areas, even of bush country, where owing to the inroad of shooters and of weasels the pigeon is no more to be seen. Sufficient was said in the second article of this series to indicate the high value of berry-eating birds and of the pigeon in particular in the economy of the indigenous forests. For a detailed description of the food of the pigeon at various seasons of the year Buller's account, drawn up from ample experience in the days when this bird had not yet begun to decrease, is hardly to be improved on. We quote it here to indicate the large number of forest species with which the pigeon enters into food relations :—

"In the spring and early summer it is generally very lean and unfit for the table; but as autumn advances and its favourite berries ripen it rapidly improves in condition, till it becomes exceedingly fat. It is esteemed most by amateurs when feeding on the mast of the miro (*Podocarpus ferrugineus*), which imparts a peculiar richness to the flesh. In January the berries of the kohutuhutu (*Fuchsia excorticata*), poroporo (*Solanum aviculare*), kaiwiria (*Hedycarya arborea*), puriri (*Vitex lucens*), mangeao (*Litsaea calicaris*), and tupakihi (*Coriaria ruscifolia*) constitute its ordinary bill of fare. From February to April their place is supplied by those of the tawa (*Beilschmiedia tawa*), matai (*Podocarpus spicatus*), kahikatea (*Podocarpus dacrydiodes*), mapau (*Rapanea Urvillei*), titoki (*Alectryon excelsum*), and maire (*Olea* spp.). It is worth remarking that in localities where it happens to be feeding exclusively on the pulpy fruit of the kahikatea it is not only in very poor condition, but acquires a disagreeable flavour from the turpentine contained in the seeds. Towards the close of this period, also, the ti-palm (*Cordyline australis*), which comes into full bearing only at intervals of three or four years, occasionally supplies this bird with an abundant feast. In May and June it feeds chiefly on the miro and pate (*Schefflera digitata*), when it reaches its prime and is much sought after. From July to September it lives almost entirely on taraire

(*Beilschmiedia tarairc*) in the North, and on hinau (*Elaeocarpus dentatus*), koeka (*Pseudopanax crassifolium*), ramarama (*Myrtus bullata*), and other smaller berries in the South. During the months of October, November, and December it is compelled to subsist in a great measure upon the green leaves of the kowhai (*Sophora tetraptera*) and of several creeping plants. It also feeds on the tender shoots of the puwha (*Sonchus oleraceus*), a kind of sow-thistle, and the flesh then partakes of the bitterness of that plant. When the bird is feeding wholly on the dark berries of the waowao the colour of its flesh is said to become affected by that of the food. The pigeon season, however, is to some extent contingent on locality; for example, in the spring of 1863 I found these birds in the upper Manawatu living on kowhai-leaves, and so lean in body as to be scarcely worth powder and shot, while in the low-timbered flats under the ranges, where they were feeding on the ripe berries of the karaka (*Corynocarpus laevigata*), they were in excellent condition."

In the above passage the botanical names of the plants mentioned have been inserted, for convenience of references, by the present writers.* The list of berries is a large one, and may be further increased by the addition of houhou (*Nothopanax arboreum*), karamu (*Coprosma robusta* and *C. lucida*), and sweetbrier (*Rosa eglanteria*).

Data are lacking as to the proportion of actual viable seed which is passed by the pigeon in eating these various berries. Only the patient observation of years can bridge this hiatus in our knowledge. Although the bulk of the pigeon's food is secured from the forest, which forms its chief haunt, it occasionally makes a sally into cleared country. On such occasions the writers have seen it eating shoots of broom (*Sarothamnus scoparius*), while Guthrie-Smith states: "They also freely feed on white-clover leaves; on fallen forest, newly sown, I have known them grow excessively fat on rape and turnip shaws." The pigeon is deservedly absolutely protected.

THE KIWIS (APTERYX SPP.).

There are in the world no more remarkable birds than the kiwis of New Zealand. They are altogether anomalous. For long the systematic ornithologist saw in them affinities with that primitive group of birds which includes the ostrich, the emu, and their relatives; but the trend of modern research, both anatomical and parasitological, is to place them nearer the rail order.

Three species of kiwi, with several races, all confined to New Zealand, are now recognized. If ever birds should be protected solely on account of scientific uniqueness the kiwis deserve that honour; yet they are in considerable danger of extermination by dogs and weasels, to which their total flightlessness has made them an easy prey.

There is probably a strong element of novelty about the suggestion that the kiwi deserves well on any other ground than pure scientific interest. The economic side of the question, especially in view of the popular belief that kiwis live almost entirely on worms, will be found

* We are indebted to Mr. Elsdon Best for the exact identification of several of Buller's plant-names. Two, however—"waowao" and "whao"—are not known to Mr. Best.

full of surprises. We have indicated previously, in the second article of this series (*Journal*, May, 1923), the highly useful role played by the kiwi as a member of the bird police force of the forest-floor—that nursery of silvan insect-life. In this sphere the kiwi is second in efficiency and utility only to the weka, a bird which has not the kiwi's clean reputation—with regard to eggs, for example. The kiwi functions firstly as a destroyer of injurious insects, grubs of borer-beetles, and other insects, and secondly as an eater (and probably therefore a dispersing agent) of the fruit of various trees, such fruit being, of course, necessarily picked up from the ground, except when borne on low shrubs.

Buller found the stomach of a single North Island kiwi to contain the following assortment: Three large wetas, ten huhus (these are the larvæ of our largest beetle, a most destructive borer, *Prionoplus reticularis* White), a large longicorn boring-beetle (*Coptomma*), several earthworms, a large earthworm egg-cocoon, and berries of maire (*Olea* spp.) and of taiko (*Fusanus Cunninghamii*). The stomach of a second contained unrecognizable insect-remains, minute land-shells, and the hard kernel of taiko-berries, which Buller suggested were used instead of pebbles for triturating the food. Other kiwis opened had eaten the berries of pokaka (*Elaeocarpus Hookerianus*), miro, maire, and hinau.

In connection with the kiwis, one last point needs further stressing. The belief is still prevalent in North Auckland that the North Island kiwi (*Apteryx australis mantelli* Bartlett) carries cattle-ticks. Undoubtedly specimens of these birds have been caught infested with ticks; and ticks generally are somewhat similar. The writers have, however, seen hundreds of ticks from kiwis, and *in no single case* was the cattle-tick (*Haemaphysalis bispinosa* Neum.) present; all were specimens of the kiwi-tick (*Ixodes* sp.), which never in any circumstances attacks stock of any description.

THE RAILS (RALLIFORMES).

Passing over the now uncommon dabchick or little grebe (*Poliocephalus rufopectus* (Gray)), the food of which, according to Buller, consists of small mollusca (including probably the fresh-water snail which acts as a host of the liver-fluke), and leaving its rare and beautiful cousin the crested grebe (*Podiceps cristatus* L.), which is likewise too scarce to be of much economic importance, we come to the large and widespread group of rails. These birds include many highly interesting and insectivorous forms, the smaller of which are so retiring in their habits as to be rarely seen, although much commoner than is usually supposed. Thirteen species have been recorded from the New Zealand region, but several are either rare visitors or stragglers or else confined to the outlying islands, so that there are only seven which are sufficiently numerous to be of any economic importance. These will be dealt with in turn.

The Pukeko (Porphyris melanotus (Temm.)).

This handsome bird follows the rule formulated in another publication by one of the present writers that if we take two related species of New Zealand indigenous birds the one which is the least related to foreign birds will be the rarer. Thus the birds which have suffered

most from the adverse influence which our civilization has consciously or unconsciously brought upon them are those which are most peculiarly New Zealand's own. In the present case the pukeko is an abundant species over large portions of the country, while its interesting relative, the takahe (*Notornis hochstetteri* Meyer), is one of the rarest birds in the world.

The pukeko, pukaki, or swamp-hen, with its magnificent blue breast, red beak, forehead, and legs, and black back, is familiar not only to many New-Zealanders but also to dwellers in Australia, where it is known as the "red-bill," a term applied in this country to a totally different bird—the oyster-catcher (*Haematopus* spp.).

FIG. 1. NEST AND EGGS OF PUKEKO.
[*Photo by T. Cockcroft.*

The nest is built on a niggerhead (*Carex secta*) or similar situation, usually in a swampy locality, and may contain a considerable number of eggs not all laid by the same female.

In Australia Cleland and his co-workers found the stomach-contents to consist of vegetable matter, presumably not further recognizable. In New Zealand the pukeko, unless present in large numbers, is a harmless or even beneficial species. Buller states that it subsists principally on soft vegetable substances, but feeds also on insects and grain. "It frequents the Maori plantations in considerable numbers and proves very destructive to the young crops, and later in the season it plunders the potato-fields and kumara-beds." But Buller noted also

that "this bird often leaves its home in the marshes to travel over the sand-dunes amongst the tauhinu bushes in quest of grasshoppers." The berry of a small *Coprosma* is also eaten.

Although formerly considered a game bird the pukeko has of recent years been protected, and probably as a consequence of this has in some districts increased allegedly to the proportions of a pest. One of the writers found these birds tame and plentiful near Whangarei, in February, 1923, and was informed that they were a great nuisance —treading down oats and eating the grain. Much of the damage is probably due to trampling rather than to actual eating of the crop. In October, 1923, a paragraph appeared in the Press, at Auckland, to the effect that "complaints which have been repeatedly made by farmers of recent years that the native swamp-bird, the pukeko, did much mischief to growing crops have culminated in the Department of Internal Affairs informing the acclimatization societies that permits might have to be granted to farmers to shoot the birds on their properties. The bird has been protected for some years, and has rapidly increased in some localities. When the matter came before the Auckland Acclimatization Society a report was received from one of the rangers that the birds picked out the young-shooted seeds from oats, wheat, and other cereal crops, and they also plucked off the thatch of stacks. Members of the council thought that the position might be met by having a general open season for the shooting of the birds in May, June, and July of each year, and it was decided to again suggest to the Department that such open season should be declared."

Guthrie-Smith, a farmer and a competent observer as well, writes: "On a large run the damage the pukeko can do is trifling. Circumstances, however, alter cases; perhaps if even I myself possessed but a few acres I should feel annoyance at rape of oats, theft of straw, ravages amongst green maize, wholesale cropping of clover and grass. As man is constituted, the intelligence and high ethical standard of the pukeko may not atone for mischief even on this petty scale."

The Smaller Rails.

Three species of the smaller rails occur throughout New Zealand, but all three have suffered considerably at the hand of cats, rats, and probably other ground vermin, and are far less plentiful than they once were. Even in the localities where they are still abundant, however, they are very rarely seen unless caught and brought home by the domestic cat. The note of the landrail, or pectoral rail, or mohopereru (*Hypotaenidia philippensis* (L.)), is a piercing scream, often heard at night but not generally recognized by country dwellers. This moderate-sized species occurs in a wider assortment of localities than do either of the very small birds or crakes—the swamp-rail, or putoto (*Porzanoidea plumbea* (Griff et Pidgeon)), and the marsh-rail, or koitareki (*Zapornia pusilla* (Pallas)), which are practically confined to swamps. All three species are purely beneficial, being almost entirely insectivorous. In the stomach of a landrail Buller found insects, seeds, and the succulent parts of various grasses. Unfortunately, the ground-frequenting habits and low nesting-places of these rails render them especially liable, as already mentioned, to the attacks of rats, weasels, and other vermin,

and their consequent decrease in the phormium swamps of the Manawatu has probably been a factor in the development of the phormium grubs (*Xanthorhoe praefectata* Walk. and *Melanchra steropastis* Meyr. into pests of importance.

The landrail was one of the species examined by Cleland and his colleagues in New South Wales, which is a portion of the range of this widely distributed bird. He states that this bird appears of some value, as grasshoppers and cutworms have been found in the stomach-contents. Needless to say, these birds are rigidly protected by law throughout the Dominion ; but from the ground vermin which are their chief foes nothing is done to save them.

The Wekas (Gallirallus spp.).

The wekas, woodhens, or Maori hens, of which we have three distinct species, are large rails, which although possessing ample wings are yet incapable of flight. It is supposed that long isolation in New Zealand, with an accompanying absence of predaceous mammals or snakes, rendered flight unnecessary to the ancestors of these birds, and disuse led to atrophy. Their considerable size, coupled with their rich-brown black-streaked plumage, differing in intensity according to the species, render them easily recognizable.

The nest is built on the ground in a variety of situations. Guthrie-Smith, who has made a special study of wekas, and whom we shall therefore quote considerably, states : " The whereabouts of the weka's nest is largely determined by the food-supply of the vicinity, and in spring-time if a beast has got bogged or a fat sheep got trapped in an ' under-runner ' it is quite worth searching for a nest in the neighbourhood. Even after the flesh is no longer fit to eat a great supply of maggots, beetles, and grubs, attracted by the carrion, provide for wekas an ample food-supply." Discussing further the situation of the nest he says : " One was on a dry limestone shelf sheltered by a huge projecting peak of the same rock. . . . Three other nests were built beneath ancient clumps of hill rush and sheltered with a natural thatch of many inches depth and of many years' accumulation."

Like our other flightless birds, though to a less extent than with the kakapo and the kiwis, the weka has suffered considerably from the influences of colonization. Dogs are its inveterate enemies, in the writer's experience rendering impossible the existence of wekas in settled districts, unless dense swamps or impenetrable cover such as gorse thickets are in abundance. So close are the interrelations of nature that we have here, in the case of the gorse and the wekas, an introduced plant protecting an indigenous bird from the attack of an introduced mammal.

The food of wekas will be considered in some detail, since in the opinion of all who have given the matter serious study these birds are among the most important economically of all the indigenous birds. In the discussion which follows our remarks will be confined to the common North Island, South Island, and Stewart Island species (*Gallirallus australis* Sparr. and *G. hectori* Hutton), since the black woodhen (*G. brachypterus* Lafresn.) inhabits a special locality and exploits a more or less peculiar food-supply.

The weka functions beneficially, firstly as a destroyer of vermin and insect pests, and secondly indirectly as a protector of most of the other indigenous land-birds. Its crimes lie chiefly in the direction of egg-stealing. It will eat fowls' eggs when it can get them, and, according to evidence quoted by G. M. Thomson, has been a serious obstacle to the establishment in this country of pheasants and wild geese. But W. W. Smith, quoted by Hutton and Drummond, believes that the weka should be held in more esteem, as "the mere destruction of a few eggs in or near the poultry-yard, or the disturbing of a few pheasants in reserves, may be overlooked when it is remembered that the weka renders inestimable services in destroying vermin." He goes on to show that the weka eats large numbers of the grass-grub (*Odontria* spp.), one of the worst enemies of pasture in New Zealand, and states that "they are also death to rats and mice and help in the destruction of young rabbits." Similarly, G. M. Thomson writes: "Mr. H. B. Flett states that a good many rabbits which had escaped from captivity at Waitahuna found their way to the open country and increased to a slight extent, but eventually died out completely. He attributes their extermination to the weka or Maori hen (*Ocydromus*) . . . They used to go into the holes and eat the young rabbits. I have seen a weka killing a half-grown rabbit." So, then, on clear country the weka is an enemy of those two important pests of our grasslands, the grass-grub and the rabbit. Yet it is on just such country that its numbers have been most seriously thinned.

Buller found that the weka ate large numbers of berries, worms, grasshoppers, crickets, beetles, mice, full-grown rats, and lizards.

Guthrie-Smith writes as follows regarding the food of the Stewart Island weka (*Gallirallus australis* var. *Scotti* (Grant)): "Eggs and young birds of certain species, no doubt, he takes in spring or summer, rats and mice when obtainable, but beetles, grubs and snails, slugs, and roots and berries are provided at all seasons by the forests and open lands, whilst the stony beeches of the inlets and coasts furnish shell-fish and crabs. It is when these birds are seen prowling along wet shores, dislodging stones as large as turnips in their open bills (the weka does not pull them towards him, he moves them entirely by grasp of mandibles)—it is then, or when rising to full height, he delivers with his bill a blow worthy of Porthos or Ivanhoe, or when he stands over a bone holding it down with one foot like a dog, and like a dog wrenching from it muscles, meat, and tendons, that you can believe that a weasel might fall before him."

When we come to the forest country we find the weka playing its second beneficial role, that of an efficient bird-protector, as first described by Guthrie-Smith in the lines quoted below. Guthrie-Smith and many other students of our birds believe that the black rat and the brown rat—introduced into New Zealand—are perhaps the most serious enemies of the indigenous birds, and have penetrated into haunts otherwise untouched by civilization. No nests are safe from their wholesale depredations.

"It is to such species as the crows, the robins, the tits, the warblers, the thrushes, the saddleback, the bush-creeper, the yellowhead, the whitehead, the wrens, the tui, the bell-bird, the pigeon, and the parrakeets that the presence of the weka is an unmixed boon. If they

still continue to survive it is to his ceaseless vigilance, his policing of the woods, his eternal patrol of them by day and night, that we owe their lives; and these species, we may say, he watches without reward. From other kinds aided in the struggle for life, such as rails, ducks, pukeko, possibly, and from the fern-bird and ground-lark, certainly he does take fair toll. It is a tribute levied fit and fair, and the merest fraction of what is robbed by rats; a mere nominal fee, in fact, charged for life insurance.

"The larger kinds of birds, such as kiwis, hawk, falcon, &c., under normal conditions watch their eggs too carefully to give the weka a chance. If in any way his presence in the woods affects these birds it is to ensure a high degree of faithful incubation. To them he is a tonic against sloth and carelessness.

"If, then, in New Zealand any serious interest ever comes to be taken in our native birds, the most efficient method of preserving the smaller tree-breeding species lies in the propagation of the weka. Of all the birds that deserve our care he comes foremost, and assistance withheld from him is help denied to half the indigenous birds of New Zealand."

If, then, the present writers have demonstrated in the previous pages of this series the overwhelming proportion of good in the activities of our indigenous birds, they have at the same time proved the economic necessity of efficient protection for the weka. All wekas are protected by law; but an intelligent appreciation by country dwellers of the birds' claims to such protection is also desirable.

The black woodhen (*G. brachypterus*) is largely a shore-frequenting species, found only in the south-west of the South Island and living largely on marine productions, but Philpott has described its behaviour during a plague of mice, which the birds were "snapping up" in large numbers.

THE SHORE-BIRDS.

The indented coast-line of New Zealand, its numerous lagoons and mud-flats, and the extensive valleys of the large South Island rivers support a large population of shore-birds, *Limicolae*, or plovers and their allies. They include twenty-nine species, some of them notable the world over for the tremendous journeys they accomplish twice annually on migration. Here we are concerned with them—or rather with only a very small proportion of them, since many are very rare, or only accidental visitors—from two viewpoints. Firstly, practically all are insectivorous to a certain extent, some almost wholly so, while others subsist largely on molluscs (so-called "shell-fish") and crustaceans (shrimps, crayfish, crabs, and their allies); and, secondly, they form a source of food-supply which has not yet been developed so extensively in New Zealand as elsewhere. A few common species may be taken as examples.

The Godwit (Vetola lapponica (Linn.)).

The godwit, commonly known as "curlew" or "snipe" (both erroneously), arrives in New Zealand in enormous numbers in spring from its breeding-haunts in Siberia, to which it returns when our southern summer draws to a close.

In spite of its great abundance, the godwit enters into little actual relation with farming operations. Its food is sought on the mud-flats exposed at low tide on estuaries and inlets.

Under the Animals Protection and Game Act this species finds a place in the Third Schedule as native game.

The Banded Dotterel (Cirrepidesmus bicinctus (Jard et Selby)).

This plentiful and beautiful little plover, with its greyish back and black-and-chestnut barred white underparts, is a familiar inhabitant of the beaches and sand-dunes in many parts of New Zealand, and a very frequent visitor to cultivated and pastoral country. On occasion it may even choose a nesting-place on arable land, laying its

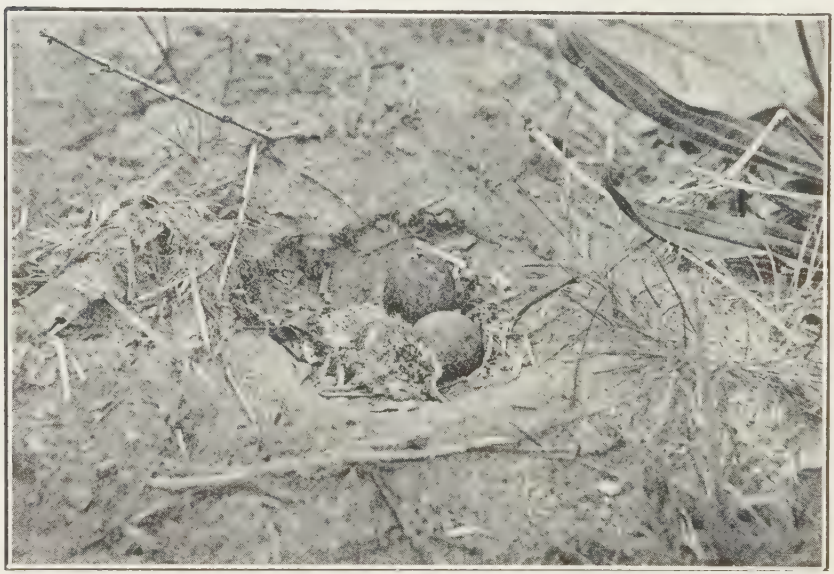

FIG. 2. NEST OF BANDED DOTTEREL, SHOWING A YOUNG BIRD JUST HATCHED AND ANOTHER COMMENCING TO CHIP THE EGG.

beautifully blotched dark-brown and olive eggs in a mere depression of the ground, sheltered perhaps by an overarching leaf of turnip or rape.

Few birds are so entirely harmless and at the same time so positively beneficial to agriculture as this little species. The diet is very largely insectivorous.

Like its rarer cousin the other dotterel (*Pluviorhynchus obscurus* (Gm.)), the banded dotterel is absolutely protected.

Other Shore-birds.

The knot (*Canutus canutus* (Linn.)), which in the Nelson Province at least (H. Hamilton) shares with the godwit the incorrect title of "snipe," is another migrant plover, far commoner in New Zealand

during the summer than has hitherto been generally realized. Together with the less plentiful turnstone (*Arenaria interpres* (Linn.)) and the eastern golden plover (*Pluvialis dominicus* (Muller)), the knot is placed on the Third Schedule as native game.

The stilts (*Himantopus* spp.), of which two kinds, a pied and a black, occur in New Zealand, are remarkable in that they possess longer legs in proportion to their size than any other bird. The edges of lagoons, the shores of lakes and of the larger rivers, and portions of the coast itself are the haunts of these birds and the source of their food, which consists largely of aquatic or semi-aquatic insects and small molluscs. They are absolutely protected.

The oyster-catchers (*Haematopus* spp.), sometimes called torea or red-bill, are almost entirely birds of the shore and river-flat. As in the case of the stilts, one species is pied and the other black. Their diet consists chiefly of crabs and molluscs, for opening which the long wedge-shaped bill is especially adapted. Both species receive permanent protection.

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Contagious Mammitis.—The last annual report of the Department of Agriculture states that this disease is still giving considerable trouble in dairy herds throughout the Dominion, and the advice and assistance of the Department's officers has been much sought after. Unfortunately, however, before the cases are reported they are, in a large number of instances, in an advanced stage of the disease, and little help can be given. Of 1,051 samples of milk received at the Department's Veterinary Laboratory during 1922–23 from cases of suspected contagious mammitis, 404, or 38 per cent., proved on examination to be of the contagious form; 218 were from cases of the non-contagious type; and the remainder (429) were normal. Wrong handling of milking-machines is often responsible for setting up udder troubles, and also for the spread of contagious-mammitis infection. The necessity for the exercise of every care cannot be too strongly emphasized.

Rabbit-proof-fencing District.—The constituting of the Te Aria Rabbit-proof-fencing District, South Auckland, has been gazetted.

THE LUCERNE-SEED CROP.

J. M. SMITH, H.D.A., Assistant Instructor in Agriculture, Marton.

THE value of acclimatized or local seed in practically all classes of farm crops is becoming more generally recognized by the farmers of this country. Perhaps this applies more to lucerne than to any other class of seed. It is a well-known fact that the variety of lucerne known as Marlborough is best suited to our conditions, and gives bigger yields and grows more vigorously than any imported variety that has not been acclimatized to this country. Our Marlborough lucerne was, of course, at one time imported, but it has been seeded and reseeded in the Marlborough District for so many years that it has now become accustomed to our equable climate, and is quite a different plant from the original imported variety. The same has been found in other countries. In Australia, for example, we find Tamworth lucerne and Hunter River lucerne; these varieties were imported probably from Asia, and grown and seeded year after year until they grew right away from the original variety—so much so, in fact, that they were renamed after the district in which they were acclimatized.

That Marlborough should be practically the only district in the Dominion producing lucerne-seed is not altogether strange. It must be remembered that the district has long been the home of lucerne in this country, and that it has a climate admirably suited for the production of seeds generally. But Marlborough is not the only district where lucerne-seed can be produced quite successfully; there are other districts that have a favourable climate and where lucerne grows quite well. The time may not be far distant, indeed, when these districts will be growing seed equal to the best Marlborough.

Up to a certain point the growing of lucerne for seed does not differ from the growing of it for hay. In fact, even if a crop is being left for seed, and for some reason or other the seed does not set well, there is still time to use that crop for hay. Much has been written as to the advisability of seeding only thin stands and stands sown in wide drills, but thick broadcast stands can be seeded equally as well as the thin or wide-drilled stand. First-year crops of lucerne should never be seeded, as the stand is then never properly established, and the proportion of weeds in a first-year crop is usually large. If the lucerne does well during the second year a seed crop could be taken from it, but as a rule it will not pay to seed a lucerne stand until the third season of its growth.

The first cut of lucerne in a season is usually made about November, and as the weather at that period is often far from certain it will generally pay to make this crop into ensilage. Even if the weather is suitable the first cut in a season ripens very unevenly, and as a rule is not the cleanest. The crop for seed should be shut up in December, and it will then be ready for harvesting about March. This will be the second cut of the season, or, if the season has been early, the third. It is not wise to leave the seed crop till too late in

the season, as it may put the harvesting into bad weather, and the climatic conditions are more the determining factor in good seed-production than any other.

It is thought by many that by allowing the lucerne-plants to reach maturity, as is the case in a seed crop, the stand itself is considerably weakened. This is not so; a stand that is left for seeding usually improves, and comes away much better after cutting. Also, there is no finer smother-crop than lucerne that has been allowed to grow to maturity.

Various theories have been put forward as to the means by which lucerne is pollinated, but it is generally understood that unless the bees are working freely among the lucerne-flowers very little seed will set. When the lucerne-flower reaches maturity it "trips," or, in other words, the flower allows the pistil to clear itself of the keel or

LUCERNE-SEED CROP IN FULL BLOOM.

boat-like structure formed by the two lower petals. This tripping may occur naturally, but more often it is brought about by the intervention of insects. Thus the flower may pollinate itself, but this is never so satisfactory as the cross-pollination by insects. If heavy rain falls during this pollination the setting of the seed will be, as a rule, unsatisfactory. Cold weather will have the same effect, as very little natural tripping takes place when the temperature is low. The ideal seeding-weather is when there is a comparative shortage of moisture during the final stages of growth.

To determine the right time to cut for harvesting requires considerable judgment, and it will depend to some extent upon the way the crop is to be subsequently handled. For instance, if the crop is to be cut with the reaper-and-binder it will need to be practically

dead-ripe, so that no undue sweating occurs within the sheaves; but where the mower is to be used it may be cut a little early, but not before the seed is properly set, and the ripening done in the swathe and cock. If the crop is to be handled by this latter method it should be cut when the pods are in the dark-brown stage and the leaves have practically all fallen. Lucerne does not ripen very evenly, and if one waits for the last pods to mature a great deal of the seed will have shed. The grower will thus have to judge the time when the greatest number of the pods are at the right stage. In harvesting the aim should be to get the material to the threshing-mill at the right stage with as little handling as possible, as handling at this stage, no matter how carefully done, causes a number of the pods to burst and the seeds to fall.

In cutting a side-delivery machine should be used, and, failing this, the machine should be followed by men with forks, who shift the cut material over so that the horses do not tread on it in the following round. The lucerne should be left in the swathes for a day or two, dependent upon the stage at which it was cut, and should then be raked carefully into windrows until dry enough for stacking. If suitable weather prevails it can be threshed quite well from the field, but as a rule it will need to be stacked. The stack should be well covered, as the ingress of water to a lucerne-seed stack plays havoc with the seed. If a barn or shed is available so much the better, as no care is too great for the lucerne crop. If put into a stack it should be left some thirty days or so before threshing, as the mass usually goes through a sweating stage during which the seed softens, and threshing should not take place before the seed hardens again. Also, the seed threshes out much better if left for some little time in the stack.

Threshing is done by means of the ordinary clover-sheller, but a larger riddle will be required for lucerne than is the case with clover. No threshing-mill cleans the seed sufficiently for the market, and a careful recleaning is necessary.

The straw after threshing is of very little value, but where it can be used to advantage is in the ensilage stack when the material is brought in in too wet a state. Here green lucerne and lucerne-straw seem to even each other up, and the resultant ensilage is good. It is not advisable to use the straw for this purpose except where the green material is exceptionally wet. If there is no other use for it the stock may be given free access to the straw-stack, and they will pick a good deal of feed out of it.

Rough-handling of Freezing-stock.—The supervising graders of the Meat Board have drawn attention to the damage to lambs and sheep caused through rough handling during transit to freezing-works. A great deal of this bruising is caused through the wool being pulled in drafting and trucking by shepherds and drovers who catch hold of the animal by the wool. Much damage is also traced to bites inflicted by drovers' dogs. Carcases which are only slightly damaged are classed second quality, while the more seriously damaged ones have to be totally rejected for shipment. The Board urges that, apart from the serious loss to the producer or buyer and the effect on the appearance of our meat exported, it is incumbent on farmers to see that attention is given to this matter for the purpose of eliminating much suffering to the animals *en route*.

ROOT-DEVELOPMENT OF LUCERNE.

Synopsis of thesis on "A Physiological Study of the Root-development of Lucerne (*Medicago sativa*) under varying Conditions of Water-supply and Fertilizer (Superphosphate)."

B. M. DAVIS, M.Sc., Department of Agriculture.

DURING 1922 the writer carried out work at Canterbury University College with the object of ascertaining, in so far as was possible, the effects of an application of superphosphate on lucerne-roots. The complete paper was presented as the thesis required for a Master's degree in the University of New Zealand.

Briefly, the method employed was to grow lucerne from seed in specially prepared vessels, to extract the entire root-system by means of a stream of water, measure it, and tabulate the results. Precautions were taken to secure maximum uniformity of soil, drainage, compaction, lighting, &c. The experiment was divided into three series, represented by plants receiving 15 in., 30 in., and 60 in. of rainfall per annum respectively. Each series was composed of two parts—namely, those plants receiving superphosphate at the rate of 2 cwt. per acre, and those receiving none. Examination of plants was made in each series after four, eight, and twenty weeks from germination.

The results, summarized, were as follows :—

(1.) The depth of penetration of the main tap-root was less in the case of the plants receiving fertilizer than in those receiving none. This was true for plants receiving 30 in. and 60 in. of rain, but the position was reversed for those receiving 15 in.

(2.) The laterals and tap-root were of a somewhat less diameter in the plants receiving fertilizer than in those receiving none. No regular difference was ascertained as regards the "diameter-quotient"—*i.e.*, the relative diameters of cortex and conducting tissues.

(3.) There was an increased amount of root developed in the surface soil in the case of those plants receiving fertilizer. The reverse was true in this investigation for the twenty-week plants.

(4.) Superphosphate did not result in the production of an increase in the total root-production, but exercised a depressing effect when combined with (*a*) heavy rainfall, or (*b*) light rainfall.

(5.) The efficiency of the roots judged from "The nutritive efficiency index" with 30 in. of rain was not altered by an application of superphosphate, but it was considerably so in the case of 15 in. and 60 in., and to approximately the same extent in both cases, the efficiency becoming much greater with an application of superphosphate. (A measure of the relative efficiency of roots may be obtained by dividing the weight of foliage produced by the total length of root-laterals.) This gives the amount of green material that may be considered arbitrarily as coming from 1 centimetre of root. By neglecting the noughts following the decimal point and treating the expression as a whole number the "nutritive efficiency index is obtained.) This is clearly a subject for further research.

(6.) Superphosphate adversely affected the germination of the seed.

It should be recognized that the plants of this investigation were grown under peculiar conditions—*i.e.*, in a greenhouse, throughout winter, with artificial heat at night. Moreover, the results apply to only one particular type of soil (a more or less virgin sandy loam) under these conditions. Correlated with similar experiments, and with investigations in the field, the results should prove a useful lead.

ACIDITY-REDUCTION IN CREAM.

A READY-RECKONER FOR USE OF SODA IN BUTTER-MAKING.

Dairy Division.

THE following table gives the amount of bicarbonate of soda required to reduce practically any quantity of cream any number of points. It is not claimed that it is correct under all conditions, this being chiefly due to the variation in the strength of the soda, but it is so close that if used in conjunction with the acidimeter no overdosing with soda is likely.

	Percentage of Reduction desired.												
	0·10	0·11	0·12	0·13	0·14	0·15	0·16	0·17	0·18	0·19	0·20	0·22	0·24
Pounds of Cream.	Pounds of Soda required.												
500 ..	0·41	0·46	0·50	0·54	0·58	0·62	0·66	0·70	0·75	0·79	0·83	0·92	1·00
600 ..	0·50	0·55	0·60	0·65	0·70	0·75	0·80	0·85	0·90	0·95	1·00	1·10	1·20
700 ..	0·58	0·64	0·70	0·75	0·81	0·87	0·93	0·99	1·05	1·10	1·16	1·28	1·40
800 ..	0·66	0·73	0·80	0·86	0·93	1·00	1·06	1·13	1·20	1·26	1·33	1·46	1·60
900 ..	0·75	0·82	0·90	0·97	1·05	1·12	1·20	1·27	1·35	1·42	1·50	1·64	1·80
1,000 ..	0·83	0·91	1·00	1·08	1·16	1·25	1·33	1·41	1·50	1·58	1·66	1·83	2·00
1,100 ..	0·91	1·00	1·10	1·19	1·28	1·37	1·46	1·55	1·65	1·74	1·83	2·00	2·20
1,200 ..	1·00	1·10	1·20	1·30	1·40	1·50	1·60	1·70	1·80	1·90	2·00	2·20	2·40
1,300 ..	1·08	1·19	1·30	1·40	1·51	1·62	1·73	1·84	1·95	2·05	2·16	2·38	2·60
1,400 ..	1·16	1·28	1·40	1·51	1·63	1·75	1·86	1·98	2·10	2·21	2·33	2·56	2·80
1,500 ..	1·25	1·37	1·50	1·62	1·75	1·87	2·00	2·12	2·25	2·37	2·50	2·74	3·00
1,600 ..	1·33	1·46	1·60	1·73	1·86	2·00	2·13	2·26	2·40	2·53	2·66	2·92	3·20
1,700 ..	1·41	1·55	1·70	1·84	1·98	2·12	2·26	2·40	2·55	2·69	2·83	3·11	3·40
1,800 ..	1·50	1·65	1·80	1·95	2·10	2·25	2·40	2·55	2·70	2·85	3·00	3·30	3·60
1,900 ..	1·58	1·74	1·90	2·06	2·21	2·37	2·53	2·69	2·85	3·00	3·16	3·58	3·80
2,000 ..	1·66	1·83	2·00	2·17	2·33	2·50	2·66	2·83	3·00	3·16	3·33	3·66	4·00
3,000 ..	2·50	2·75	3·00	3·25	3·50	3·75	4·00	4·25	4·50	4·75	5·00	5·50	6·00
4,000 ..	3·33	3·66	4·00	4·33	4·66	5·00	5·33	5·66	6·00	6·33	6·66	7·33	8·00
5,000 ..	4·16	4·58	5·00	5·41	5·83	6·25	6·66	7·08	7·50	7·91	8·33	9·16	10·00

Pounds of Cream.	Percentage of Reduction desired.												
	0·26	0·28	0·30	0·32	0·34	0·36	0·38	0·40	0·42	0·44	0·46	0·48	0·50
	Pounds of Soda required.												
500 ..	1·08	1·16	1·24	1·33	1·41	1·50	1·58	1·66	1·75	1·84	1·91	2·00	2·08
600 ..	1·30	1·40	1·50	1·60	1·70	1·80	1·90	2·00	2·10	2·20	2·30	2·40	2·50
700 ..	1·51	1·62	1·74	1·86	1·98	2·10	2·21	2·33	2·45	2·56	2·68	2·80	2·91
800 ..	1·72	1·86	2·00	2·12	2·26	2·40	2·52	2·66	2·80	2·92	3·06	3·20	3·33
900 ..	1·95	2·10	2·25	2·40	2·55	2·70	2·84	3·00	3·15	3·28	3·45	3·60	3·75
1,000 ..	2·16	2·32	2·50	2·66	2·83	3·00	3·16	3·32	3·50	3·64	3·83	4·00	4·16
1,100 ..	2·38	2·56	2·75	2·92	3·11	3·30	3·48	3·66	3·85	4·03	4·20	4·40	4·58
1,200 ..	2·60	2·80	3·00	3·20	3·40	3·60	3·80	4·03	4·20	4·40	4·60	4·80	5·00
1,300 ..	2·80	3·02	3·25	3·46	3·68	3·90	4·11	4·32	4·55	4·76	4·98	5·20	5·41
1,400 ..	3·03	3·26	3·50	3·73	3·98	4·20	4·42	4·66	4·90	5·12	5·36	5·60	5·83
1,500 ..	3·25	3·50	3·75	4·00	4·25	4·50	4·75	5·00	5·25	5·50	5·75	6·00	6·25
1,600 ..	3·46	3·72	4·00	4·26	4·52	4·80	5·06	5·32	5·60	5·86	6·13	6·40	6·66
1,700 ..	3·68	3·96	4·25	4·52	4·81	5·10	5·38	5·66	5·95	6·23	6·51	6·80	7·08
1,800 ..	3·90	4·20	4·50	4·80	5·10	5·40	5·70	6·00	6·30	6·60	6·90	7·20	7·50
1,900 ..	4·11	4·43	4·75	5·06	5·38	5·70	6·01	6·33	6·65	6·96	7·28	7·60	7·91
2,000 ..	4·33	4·66	5·00	5·33	5·66	6·00	6·32	6·66	7·00	7·32	7·66	8·00	8·33
3,000 ..	6·50	7·00	7·50	8·00	8·50	9·00	9·50	10·00	10·50	11·00	11·50	12·00	12·50
4,000 ..	8·66	9·33	10·00	10·66	11·32	12·00	12·66	13·33	14·00	14·66	15·33	16·00	16·66
5,000 ..	10·83	11·66	12·50	13·32	14·16	15·00	15·83	16·66	17·50	18·32	19·16	20·00	20·83

Careful experiment with cream ranging from 0·2 to 0·7 per cent. of acidity has shown that 1 lb. of Crescent brand soda (the brand most commonly used) will reduce the acidity of 1,000 lb. of cream 0·12 per cent., and the table has been calculated from these figures. The first column represents the number of pounds of cream to be utilized. The top line is the percentage of acidity to be taken out of the cream, not the acidity of cream, in the vat. To find the number of pounds of soda required subtract the acidity desired from the acidity of the cream in the receiving-vat, then follow along the line opposite the number of pounds of cream in the vat until the column under the percentage of acidity to be taken out is reached. For example, the reduction of 1,500 lb. of cream from 0·5 to 0·2 will require 3·75 lb. of soda.

For the table to be of value every care must be taken. The quantity of cream must be known to a few pounds. It must be thoroughly mixed so that the sample tested is representative of the whole. The test must be properly made, and the soda weighed correctly and completely dissolved. The soda solution must be carefully stirred into the cream. To get the weight of cream correct add up the suppliers' dockets as the cream is being weighed in, and put a mark on the vat for each 100 lb. added.

Board of Agriculture.—Mr. W. D. Pike, of Blenheim, has been appointed as a member of the Board of Agriculture, representing the Marlborough, Nelson, and Westland Districts, in place of the late Mr. J. A. Haycock.

STRYCHNINE AND ITS POISONOUS ACTION.

TREATMENT IN CASES OF ACCIDENT.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

STRYCHNINE is a plant alkaloid of very decided characteristics. The alkaloids (from *al-kali*, an Arabic word meaning "ashes," and *eidos*, a Greek word meaning "resemblance"—literally "like an alkali") are a class of organic bodies burning away completely on ignition, and are highly analogous to the inorganic bases, the alkalis, which are incombustible.

Alkaloids resemble the alkalis generally in having an alkaline reaction, in neutralizing acid to form salts, and in many other respects. Familiar examples of other alkaloids are the nicotine of tobacco, a liquid alkaloid highly poisonous, and the caffeine of tea and coffee, and quinine from cinchona-bark, which are mildly poisonous. Examples of alkalis are soda, potash, and quicklime.

The alkaloids are obtained from many sources. Artificial alkaloids may be prepared in the laboratory, while the natural alkaloids may be obtained from either plants or animals. Those derived from plants are termed "plant alkaloids" or "plant bases." These vary greatly in their poisonous effects, their degree of poisonousness, their degree of stability, and their form.

Thus one of the most poisonous of all is nicotine, the fatal dose of which, for an adult human being not habituated to the use of tobacco, is 6 milligrams (0·006 gram, or 0·0925 grain), according to Wynter Blyth. Strychnine is far less poisonous than nicotine. Taylor estimated the fatal dose for adults as between 32·4 to 129·6 milligrams. Other alkaloids are so feebly poisonous that they can be taken in relatively large quantities. Tea-leaves contain from 1 to 5 per cent. of caffeine, and we know how much of this we daily consume. The alkaloid pukateine, which the writer isolated from the pukatea-tree, is so mildly toxic that it would take 17,000 milligrams, or about $\frac{2}{3}$ oz., to cause poisoning symptoms in an adult man. The writer has himself taken 100 milligrams without experiencing the slightest effect. If enough be taken it has a strychnine-like action.

Some alkaloids are unstable—that is, they decompose into other compounds; but strychnine is extremely stable, and may be detected in animal-remains years after death. The skeletons of rabbits poisoned by strychnine may therefore remain poisonous for years, as the dried flesh and viscera adhering to the bones still contain the unaltered poison.

The form of alkaloids varies. Some few are coloured, but most are white when pure; some are liquids, but most are solids; some are non-crystalline, but many are either crystalline or form crystallizable salts with the common mineral or organic acids. One discovered by the writer in pukatea-bark—laureline—is itself amorphous or non-crystalline, but forms beautifully crystalline salts.

Alkaloids also vary in their volatility, solubility, taste, smell, the reactions which they give with oxidizing chemicals, and in their

physiological action on animals—some, like morphine, acting as narcotics in inducing torpor or sleep ; others, like caffeine, as excitants and stimulants, induce wakefulness. Hence one alkaloid may be used as an antidote for another, and this treatment is very valuable if applied in time.

SOURCE AND NATURE OF STRYCHNINE.

Strychnine is obtained from the seed of the nux-vomica tree (*Strychnos Nux Vomica*), of the family Loganiaceae, a small tree indigenous to India, Siam, and northern Australia. Another source is from St. Ignatius "beans," which are the seeds of *Strychnos Ignatii*, a stout climbing-plant indigenous to the Philippine Islands. There are two alkaloids in *Strychnos* seed—namely, strychnine and brucine—which exist in nearly equal proportions, totalling about 3 per cent. of the seed. The seed is known in commerce as "beans" ; "seed" is, however, the correct botanical description. In New Zealand there is no member of the genus *Strychnos ; Geniostoma ligustrifolia*, a common shrub in the North Island, belongs to the same family as *Strychnos*, but apparently contains no poison. There are many other species of *Strychnos* inhabiting the warmer parts of the world, but the foregoing are the most important.

Strychnine is sold usually in the form of colourless, transparent, prismatic crystals, or, when powdered, as a white crystalline powder, odourless, but having an intensely bitter taste, which is perceptible in solutions as dilute as 1 of strychnine in 70,000 of water. *(Strychnine should, of course, be tasted with extreme caution.)* The crystals are non-volatile and permanent in air, not changing in colour or nature as do some other alkaloids. To dissolve 1 part of strychnine it takes 6,000 parts of water, or 110 parts of alcohol, or 5,500 parts of ether, or 6 parts of chloroform. Strychnine melts at a temperature of 268° centigrade (514° F.), and on raising the temperature higher it burns away, leaving no ash. Its solution turns red litmus test-paper blue (alkaline reaction). Its behaviour to concentrated sulphuric acid is unusual, for on adding a drop to a crystal on a white saucer no charring or other coloration occurs, but on adding a crystal of bichromate of potash to the solution in concentrated sulphuric acid a deep-blue colour is produced, which changes quickly to a deep violet, purplish-red, cherry-red, and finally to orange or yellow. This play of colours which strychnine gives with sulphuric acid and bichromate of potash is the convincing test for strychnine. The smallest particle will give this reaction ; nor is any other compound known which gives the same brilliant colours in the same sequence as stated, although some alkaloids do give colour reactions with this reagent. No suspected substance can be held to be strychnine unless it is extremely poisonous, excessively bitter, and gives the foregoing colour reaction.

Strychnine, although practically insoluble in pure water, dissolves readily if the water is acidulated with any of the common mineral acids, or with vinegar, acetic acid, and some other organic acids. Salts of strychnine made by combining it with hydrochloric, nitric, or sulphuric acid are obtainable in the form of fine white crystals, which are soluble in water. They have the poisonous properties of strychnine, but have not proved as efficacious in practice as a vermin-poison. It is important that buyers of strychnine for poisoning rabbits and birds should specify

that the base strychnine is required and not any of the salts of strychnine. Strychnine will be in bottles labelled as such, whereas the salts will be labelled "strychnine sulphate," "strychnine hydrochloride," or "strychnine nitrate," or some abbreviation to denote these names.

POISONOUS ACTION OF STRYCHNINE.

Strychnine has long been used as a vermin-poison. In poisoning flesh-eating animals or birds it was recommended to insert the alkaloid in the stomach of a small animal recently killed. The poison thence became diffused throughout the carcase, which formed the bait. In poisoning birds with strychnine it was the practice to sell grain which had been steeped in a solution of the alkaloid. This grain is not nearly so effective as that prepared by dusting the finely powdered poison on to the damped grain. In poisoning with strychnine it is desirable, by using liberal quantities, to avoid undue cruelty. The animal then obtains a lethal dose and quickly succumbs.

Strychnine is extremely poisonous to all kinds of life, although some animals are more susceptible than others to this poison.* Thus the fatal dose when injected under the skin of a rabbit is from 0·5 to 0·6 milligram per kilogram ($2\frac{1}{5}$ lb.) of body-weight, but a domestic fowl will require four times this quantity. Indeed, fowls are so resistant to strychnine that they are sometimes regarded as immune to that poison. Two incidents may be quoted which illustrate this: Some fowls (culls) were put in a pen, and a mash of pollard and strychnine given. The small birds came down in hundreds and fed with the fowls as usual. The fowls showed only a slight "grogginess" afterwards, whereas the small birds perished. A farmer, suspecting that his poisoned wheat was not up to strength, gave it to some fowls to try, and was wrongly confirmed in his suspicions when nothing happened to the fowls. Strychnine is certainly the most suitable poison for small birds, as the writer has shown in Leaflet No. 66 (printed in 1903), which is still available, though amended by a later article. In this method the strychnine, in fine powder, is dusted on to the wheat, which has been damped with a sugary solution (see *Journal*, August, 1917, p. 68).

The rabbit is one of the most susceptible animals to strychnine poison, and in field practice it has been found that when the crystals, finely powdered, are distributed on the bait, consisting of sliced or minced carrots, swede turnips, or apples, the poisoning is most effective. The proportions used are those first recommended in the above-referred-to leaflet for birds (see *Journal* for January last, or Bulletin No. 110). A mixture of oats and molasses has been used as a bait very effectively, and has the advantage that the ingredients may always be had when other baits are unobtainable.

There are several points which are worth investigating with regard to the use of strychnine for destroying vermin in New Zealand. Strychnine is very expensive, although a highly efficient poison, costing

* When given by the mouth, as in field practice, it is probable that much more strychnine is required as a lethal dose than when injected under the skin. The minimum fatal dose of tutin, the active principle of the tutu-plant (discovered in this Laboratory), injected is 2·5 milligrams; when given by the mouth it is 6 milligrams.

5s. per ounce even when imported in wholesale quantities. It is probable that the demand will grow and that very large quantities will be required in future. It seems reasonable that the strychnine should be received on the farm already powdered, or in such small crystals that powdering is unnecessary. What should we think if farmers were asked to powder their their own fertilizers on the farm? Powdering on the farm leads to waste, delay, and danger. A mortar which is used for powdering strychnine one day may be used for making icing-sugar for the wedding-cake the next, and then a funeral may not be far off. Of course, it is easy to clean the mortar thoroughly by washing it with acidulated water, but this in the hurry of farm-work may be overlooked.

Of the two alkaloids in the *Strychnos* seed, only the strychnine is used, but as the brucine is also poisonous (through less so than strychnine) it might be advisable to ascertain what the total crude alkaloids from the extraction of the seed could be supplied at, and whether the reduction in price would warrant its use. It might also be possible to grow the seeds in some of the tropical territories of this Dominion, and thus create a new industry.

POISONING OF HUMAN BEINGS AND DOMESTIC ANIMALS.

The action of strychnine on the animal-body is as distinctive as those reactions it gives to chemical tests. A medical man is not likely to mistake the symptoms produced by strychnine for those produced by any other cause. No one who has ever seen a dog poisoned by strychnine and the stretched-out rigid appearance the body assumes in the convulsions will ever forget the sight.

In the poisoning of human beings by strychnine the symptoms come on very quickly—usually in from five to twenty minutes. Usually when taken accidentally the patient is warned by the excessively bitter taste of the strychnine compound that something is wrong. If so, the sooner an emetic can be administered and vomiting induced the better, as strychnine is absorbed with great rapidity, and the longer the administration of the emetic is delayed the less chance there is of effective removal of the poison.

The prominent symptoms which follow the taking of the poison are, firstly, a sense of uneasiness and restlessness, and a feeling of impending suffocation; then a shuddering or trembling, with twitchings or jerkings of the limbs and head. Finally, these are succeeded by convulsions in which nearly all the muscles are simultaneously affected; the limbs are stretched involuntarily, the hands are clenched, the soles of the feet bend inwards, the legs somewhat separated. The body becomes arched, the head bent forcibly backwards, and the front of the body is projected, so that the patient rests on the back of the head and heels, the neck is stiff, and the body unnaturally rigid. Slight causes bring on the convulsions, such as a noise, the banging of a door, &c.

There is no loss of consciousness during these attacks, the intellect being quite clear to the last, and the horror of impending death is very acute, and is manifested in the expression on the patient's face, who fears to be left alone. There are other symptoms, but the foregoing

are sufficient to indicate what a horrible poison strychnine is, and how necessary it is to guard against the poison being accidentally taken. The fatal dose for adults ranges from ½ grain to 2 grains. Records show that in the majority of cases if a patient survives the first two hours after taking the poison he, as a rule, makes a complete recovery.

The following is the procedure recommended by the Health Department for strychnine poisoning in the case of human beings :—

If a person has, accidently or otherwise, swallowed any strychnine, act quickly as follows :—

(1.) Send for a doctor.

(2.) Before doctor arrives, give emetic such as mustard or common salt, one tablespoonful in one half-pint of warm water. After vomiting has been induced give three grains (as much as will conveniently lie on a threepenny-piece) of potassium permanganate in one half-pint of water, or give strong tea, or charcoal suspended in water.

(3.) After doctor arrives he will treat other symptoms.

The treatment recommended by the Live-stock Division for strychnine poisoning in the case of domestic animals is as follows :—

General : Keep the animal quiet, warm, and comfortable.

Dogs and cats : Give an emetic consisting of a solution of common salt or mustard, followed by a purgative of Epsom salts and any of the preparations recommended for other animals.

Horses, cattle, sheep, and pigs : A purgative should at once be administered —Horses, linseed-oil ; cattle and sheep, Epsom salts ; pigs, castor-oil. This should be followed by turpentine, chloral hydrate, or chlorodyne—whichever is at hand.

Doses : Turpentine in oatmeal gruel—horses a wineglassful ; cattle, two wineglassfuls ; sheep and pigs, a teaspoonful ; dogs, ten to twenty drops. Chloral hydrate or chlorodyne—horses, 1 oz. ; cattle, 2 oz. ; sheep and pigs, one teaspoonful ; dogs and cats, ten to twenty-five drops of chlorodyne, or ½ dram of chloral hydrate.

GRADING OF NEW ZEALAND HONEY FOR EXPORT.

Horticulture Division.

THE following notes have been prepared with a view to presenting the objects aimed at and methods followed in the grading of honey for export, as adopted by the New Zealand Department of Agriculture and carried out by the Apiary officers of its Horticulture Division.

Primarily honey is graded to ensure evenness of colour, flavour, and packing, to safeguard the name of our product on the oversea markets, to ensure that unripened honey shall not be despatched, and to prevent odd lines of honey collected from the various districts being exported irrespective of quality, colour, or packing.

STANDARDS AND GRADES.

The differing flora from which honey is derived in New Zealand and the varying seasons make the process of classifying honey into grades somewhat difficult. However, after due consideration in dealing

with the classes of honey produced, it has been possible to evolve standards for colour and flavour quite suitable for the grading of all honey offered for export. At the inception of our grading-system, when the standards were being evolved, it was necessary to hazard to some extent the requirements of the British markets. The same opportunities had not been presented to the graders of honey as to graders of other produce to determine the actual requirements of the British merchants in respect to flavour and colour. With no first-hand information the only guide to the situation was the price obtained for shipments of honey from time to time. It was noticed that the water-white and white honeys, which are delicately flavoured, invariably brought higher values than honeys darker in colour and more pronounced in flavour. Taking the white honeys as a basis, it was recognized that all New Zealand honey could be placed into three grades. These were designated Special, Prime, and Good.

Reference here to the grades would not be complete without some definition of those classed under the headings just mentioned. Special-grade honey is one having a choice delicate flavour, bright in colour, delicate in aroma, fine in grain, firmly conditioned, free from scum, and well packed. Prime grade may be an excellent table honey, but with a flavour more pronounced than allowable in Special grade. Good grade may be a fair honey and suitable to some palates for table use. In all grades honeys of finer flavour may be reduced to a lower grade through loss of points in items other than flavour.

COLOUR.

It is obvious that as the honeys produced vary considerably in colour, ranging from water-white to dark, no system of grading would be complete unless allowance were made for classifying the honey exported into separate colour-classes. Thus provision is made for five colour-classes—namely, water-white, white, light amber, medium amber, and dark. Consequently all honey for export, besides being divided according to texture and flavour into either Special, Prime, or Good grade, is further subdivided according to colour into the classes of water-white, white, &c., just referred to.

When a sample is taken for determining the colour it is carefully melted and placed into a small tube and compared with the colour-glasses, and, if clear, is posted to its colour-class. If the sample when melted is found to be cloudy or dull, and the characteristic brightness is absent, the small bottles containing the honey are placed in a Babcock tester and revolved, this operation throwing all the air-bubbles, &c., to the surface, and in this way a true estimate of the colour is obtained. Should the honey after the latter operation remain dull in appearance points are deducted under the heading of "Colour" when the score is being made out.

Notwithstanding that a sample from each separate line or case of honey, if necessary, is melted, considerable difficulty is experienced at times in determining the placement of border-line colours. In all cases where liquefying is necessary to determine colour, great care has to be exercised in order to avoid overheating during the melting process, otherwise the particular sample is apt to be relegated to a darker class than that to which it really belongs. With few exceptions

the determining of colour without first liquefying a sample of the honey will prove unreliable; consequently any effort to gauge colour by the appearance of the honey in the tins would be far from complete, and would make for the incorrect classification of the honey.

CONDITION.

Another important factor to be considered is that of condition. Honey in good condition should be firmly granulated, free from the slightest trace of ferment, and, if contained in airtight containers, keep indefinitely if not subjected to high temperature. The bulk of the honey produced in the Dominion granulates firmly. However, it sometimes happens that through careless manipulation or other causes a beekeeper sends forward for export lines which are termed "soft granulated." When honey the keeping-quality of which is doubtful is met with in the grading-store its possibilities in the direction indicated are immediately tested by means of a specific-gravity test. If a liquid sample of the honey at a given temperature registers below 1·420 it is not considered sufficiently ripe for export. The specific-gravity test used has been the cause of the rejecting of quantites of honey, and without its use no doubt a much larger quantity would have found its way to the British market in a fermented condition.

In the process of grading points are allotted for grain and freedom from scum. Honey of a gritty nature receives fewer points than that which possesses a nice smooth, even grain. Dealing with scum the grader uses his judgment as to the amount on the honey that will pass. Excessive scum containing wax-particles, dead bees, &c., results in lines being rejected for export.

FINISH AND PACKING.

Apart from the question of grading, the exporter is called upon to give some consideration to the finish and packing of the lines he is exporting. It is compulsory for the beekeeper to pack in new tins and strongly constructed cases. The tins have either to be oiled or lacquered as a prevention against rust, and they must not contain more than 60 lb. of honey. The cases are strapped with metal strapping as additional protection.

GRADE-STAMP AND CERTIFICATE.

When the honey is finally passed a grade-stamp is affixed to the cases, indicating the colour and grade of the honey. A grade-certificate covering each line so graded is then issued.

Noxious Weeds Orders.—The Tuapeka and Clutha County Councils have declared Californian thistle and ragwort *not* to be noxious weeds within their respective territories. The Waikouaiti, Waitomo, and Waikohu Counties have similarly declared Californian thistle only. The Kaikohe Town Board has declared gorse and Cape daisy to be noxious weeds within its district; the Papakura Town Board has similarly dealt with ox-eye daisy; and the Portobello Road Board with gorse and broom. The Tahunanui Town Board has declared all the plants in the Third Schedule of the Act to be noxious weeds.

CIDER-MAKING.

PRACTICE FOR NEW ZEALAND CONDITIONS.

(Continued.)

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

PREPARATION OF THE MUST.

THE apple-juice flowing from the press-cloths is generally fairly clear, though not entirely free from visible solids. To remove these it is advisable to run the juice through a couple of hair or wire sieves, the lower one having a finer mesh than the one placed immediately above it. The juice thus treated will be sufficiently clear to run directly into ordinary barrels to be fermented, or to be pumped from a temporary or specially constructed receptacle beneath the press into fermenting-vats in the cellars.

When sufficient juice has been conveyed into the fermenting-vessel, and before any fermentation sets in, the quantity of solids contained in the juice should be ascertained and duly recorded on the vessel itself, or in a book kept for the purpose. There are small quantities of matters other than sugar included in the total solids, but for practical purposes the whole can be considered as sugar.

The majority of orchardists possess a Baumé hydrometer with a scale from 0° to 50° for liquids heavier than water, which they use for testing the density of their lime-sulphur spray-solutions. The same hydrometer can be used for testing the density of apple-juice. In case such an instrument is not available it can be procured from one of the scientific-instrument sellers, together with a test-glass, for a few shillings. If purchasing a Baumé specially for cider-making it is preferable to obtain one graded from 0° to 20° or 25°. The degrees on these are farther apart on the scale and are therefore easier to read correctly.

The Baumé is graduated at 60° F. or 15° C., and the juice to be tested should be as near as possible to that temperature. Should the temperature be above 60° F., add 1 degree to the degree Baumé recorded for every 15 degrees F. above 60; or, if below, deduct 1 degree Baumé for every 15 degrees F. below. Read the degrees Baumé in a line with the main surface of the liquid, not at the point it has mounted to on the spindle by capillarity.

The Baumé hydrometer has an arbitrary scale as far as cider is concerned, but, as already mentioned, it is generally to be found in the hands of the orchardists or is easily procurable. By a happy coincidence the degrees Baumé (varying as a rule from 6° to 9°) in apple-juice, if reduced by 2, will give approximately the percentage of alcohol the cider will contain on complete fermentation. (Wine-makers will notice that the approximate ratio of sugar to solids in apple-juice is not the same as that in grape-juice.) Apple-juice registering 8° Baumé will result in a dry or hard cider containing very near to 6 per cent. of alcohol by weight.

The sugar contents of the must can be gauged more exactly by analysis, but the exact amount of alcohol that will be produced in the cider cannot be prognosticated exactly, as it will be rarely found that two barrels of juice, though made from the same varieties of apples, are of exactly the same composition, nor will they ferment out under exactly the same conditions. The indications obtained by the use of the Baumé hydrometer, as already explained, will be found on the analysis of the completely fermented cider to be very nearly exact —quite near enough for the purpose.

Should the saccharine contents of the must be insufficient to produce the alcoholic strength desired in the finished cider, then for each additional 1 per cent. of alcohol desired add 4 oz. of No. 1A cane-sugar to each gallon of must, dissolving it thoroughly by stirring. If, on the contrary, a lighter cider is required for quick home consumption after making, water can be added to reduce the solids. Only small quantities of either sugar or water should be employed; an excess of either will change the nature of the beverage. An addition of both sugar and water would constitute the fraud known among wine-makers as "stretching" or "sophistication."

The proportions of acidity and tannin in ripe New Zealand apples are generally suitable for making a good cider, and can be judged approximately by taste. The exact proportion need only be ascertained when making cider on a commercial scale, and will be dealt with later.

The practice of filtering the fresh apple-juice before fermentation is not advisable. The mucilaginous and albuminous nature of the solids clogs the filtering-material very rapidly, and renders the process very slow even under heavy pressure. It is, moreover, very doubtful whether apple-juice from which these substances, containing some of the food of the ferments, are extracted would produce a cider which would justify the extra cost and trouble. Filtration should be reserved for treating ciders that have not cleared naturally or after successive rackings, and when they are otherwise ready for bottling.

FERMENTATION.

The juice can be left in an open vat to ferment for a few days till a crust forms on the surface of the liquid, and a thick deposit, known as "lees," forms on the bottom of the vat. The crust is then skimmed off, and the clear juice is run off the lees into the fermenting barrels or vats. Many advantages are claimed for "keeving" as this process is called, the principal of which is that it rids the juice of undesirable solids. The principal objections to it are the cost of double handling and the extra vat required. Owing to the surface of the liquid being exposed to the air there is also more risk of contamination from vinegar bacteria, the bugbear of cider-makers. Besides those which may enter from outside, there are always a few of these organisms in the juice waiting for favourable conditions to increase. Exposure to the air furnishes these conditions, and for this reason, throughout the whole process of cider-making, the greatest care should be taken to avoid all unnecessary contact of the cider with the air.

A more rational method for the production of a high-class cider is to obtain the juice as clear as possible from the press and run it

directly into barrels or closed vats, filling them to the bung-hole or leaving a space above the liquid in the vessel. Fermentation will start spontaneously, and will generally be observed after two or three days, or it may take longer in the case of the first barrel or if the weather is very cold. In the barrels or vats which have been filled up, and in which fermentation has commenced, the froth will begin to ooze out of the bung-holes. These should be placed a little on one side, so as to allow the froth to run down one side only of the barrel into a basin, or a trough if there are several barrels, placed underneath. These barrels or vats should be kept filled up and the froth wiped away daily from the sides, and the basins emptied and cleaned, or the troughs swilled down with lime-water.

Where a space has been left above the must (about 6 in. in a 40-gallon barrel) the froth forms a crust on the surface, and sinks into the liquid when the first tumultuous stage of fermentation subsides. At this period the containing-vessel should be filled with fermenting juice from another barrel, or with cider from a previous brewing, or, failing both, with clean water.

By both of the foregoing methods a good cider can be produced, on condition that the utmost cleanliness is observed, and the barrels or vats are absolutely sweet and clean and free from vinegar and mouldy flavours when they are filled.

Where there is a choice of location for the purpose of fermentation the coolest one should be preferred, as, all other conditions being equal, the finest cider is produced by a slow fermentation at a low temperature. The ideal condition would be a uniform temperature of 40° F. —a condition which can only be obtained by artificial means, and the cost of which would be prohibitive to producers of small quantities.

Another most important condition both during and after fermentation is the exclusion of air from the surface of the cider. If a strong barrel with good sound hoops is used for fermentation, and a small space is left above the liquid, the barrel can be bunged down tightly as soon as the fresh juice is poured in. The gas formed by fermentation will escape through the pores of the wood, and the fermentation will proceed more rapidly than if the bung-hole were left open.

The objection to the foregoing procedure for the production of any but dry cider is that the progress of the fermentation cannot be followed by testing the liquid from time to time with the hydrometer, which will gradually sink as the sugar is split up into alcohol and gas by the action of the ferments or yeasts. As long as the air can be excluded from the surface of the cider there will be no danger of acetification. A sufficient amount of carbon-dioxide gas, which is heavier than air, can be retained on the surface of the fermenting liquid by placing a small bag of clean sand, about 6 in. square, over the bung-hole. Another method is an air-trap made by fixing a V-shaped piece of glass tubing, having the arms about 6 in. long, into a hole in the bung. The bung is then fixed tightly in the barrel, and the free arm of the tube placed in a glass of water on the barrel. While fermentation continues the surplus gas will escape, causing bubbles to rise in the water, and the air will be excluded thereby. The rapidity with which the bubbles rise will give a good idea of the process of

fermentation, and the cessation of the same will indicate that the action of the ferments has ceased and a dry cider has been produced.

No exact period for complete fermentation can be given—so many factors are liable to influence this, such as the composition of the must, temperature of fermenting-room, &c.

RACKING.

The object of racking the cider is to separate the clear liquid from the lees or deposit formed in the bottom of the barrel. At least two rackings should be made before bottling the cider—the first one when the tumultuous phase of fermentation is over and the cider is fairly clear, and the second before the density is reduced by fermentation below 2° Baumé, or before bottling if it is intended to bottle at a higher density. It is advisable to rack at about half a degree above the degree at which it is intended to bottle, in order to allow for further fermentation between the time of racking and bottling. Supplementary rackings can be employed for clearing the cider and for slowing down and prolonging the fermentation.

A cold, bright day should be chosen for racking. The simplest way to operate is by gravitation, running the cider into a lower cask through a rubber tube used as a siphon. A small cup should be so placed at one end of the tube that the suction will not cause the lees to rise, and the tube then attached to a stick or cane, so that when the stick is introduced into the barrel and the end of the stick is resting on the bottom the tube will be well above the lees. When the barrel is nearly empty the tube can be gradually lowered until the liquid becomes cloudy. A section of glass tubing inserted in the rubber tube, and a light placed behind it if necessary, would greatly facilitate operations.

BLENDING.

As has already been mentioned, a considerable amount of blending is done by mixing different varieties of apples before milling, but only those apples which are in a fit condition to be ground at the same time are blended. Other varieties ripening at other periods are also blended in their turn. It is evident that these different blends will produce finished ciders differing from each other in flavour and their general constituents. The general public do not appreciate these differences, but look for a uniform article when purchasing their cider regularly from the same cellars. To comply with these conditions it is necessary to meet the customer's taste as far as possible by blending the ciders of different periods, so that a uniform cider can be delivered for one year at least. Special blends can also be made to produce a better cider than the bulk, to be sold at a higher price. This naturally calls for a first-class palate and some experience.

The art can also be utilized in small cellars by blending ciders having a preponderance of certain constituents, such as acidity, with ciders lacking in acidity. Care should be taken, however, that none of the ciders to be blended are diseased. A common mistake in this relation is to mix ciders having a vinegar taint with sweet cider in the hope of diminishing the defect, the inevitable result being that the taint is communicated to the whole of the blend.

Blending should be done some time before the cider is ready for bottling, when the Baumé hydrometer records about 5°. The mixing of the ciders stimulates the action of the ferments, and will necessitate an extra racking when the fermentation calms down. For this reason it is useless to filter before blending.

FILTERING.

In commercial cideries it is the practice to filter all ciders directly before bottling, so as to produce a bright uniform article. Several filterings are sometimes necessary to attain this object. The effect of filtering on those qualities which appeal to the palate are disputed. English and German authorities claim an improvement, while the leading French authorities claim the contrary, though they agree that filtering is advisable for ciders which do not clear after several rackings.

There are several types of filters, the filtering-material used being generally cellulose or asbestos arranged in heavily tinned frames or drums. The cider is forced through the filter by hand or a power pump, and does not come in contact with the air. The price of effective filters is unfortunately too high to justify their being employed for filtering small quantities. The old felt bag filters are effective so far as clearing goes, but the process is too slow, and they expose the cider too long to the oxidizing influence of the air and probable infection by vinegar bacteria.

(To be continued.)

SAND-DRIFT AREAS.

THE question of controlling the drift of sand in certain localities on the west coast of the North Island again came before the Board of Agriculture at its meeting this month. After full consideration the following resolution was adopted: "That a new Act or an amendment to existing legislation should be passed empowering settlers to form 'reclamation areas,' with power to elect Boards to administer the same, and with power to levy rates on the land contained within the area under the Board's jurisdiction for the purpose of planting timber-trees and other plants necessary for the creation of forests on sand-drift areas." The Board also suggested that such tree-planting be carried out under the supervision of the State Forest Service.

During the last three years the Forest Service has been carrying out experimental reclamation operations near the Rangitikei River mouth, and very satisfactory results have been obtained so far.

AUSTRALASIAN ANGORA AND MILCH-GOAT BREEDERS' ASSOCIATION.

A GOAT-FREEDERS' association with the above title has been formed in New South Wales. The objects of the association are stated to be: (1) To further the interests of the Angora and milch-goat industries, and the maintenance of the purity of the breeds; (2) to obtain and supply information regarding the character and history of Angora and milch-goats; (3) to protect the interests of goat-breeders. The association's financial year is from 1st October to 30th September. The annual subscription for members is 10s. 6d., and that for associate members 2s. 6d. Associates have the same privileges as full members, with the exception of voting-powers. The honorary secretary of the association is Mr. E. F. Lane, Enalfern, Burgooney, N.S.W.

SEASONAL NOTES.

THE FARM.

AUTUMN-SOWING OF OATS.

Oats for winter and spring feed and subsequent harvesting should be sown not later than April or early in May. Where they are following a fed-off crop of turnips manure may not be necessary, but on land that has had a crop carted off it is best to use from 1 cwt. to 2 cwt. Suitable fertilizers are mixtures of half superphosphate and half Nauru, Ephos, or a similar phosphate; or 1 cwt. of superphosphate may be applied with the seed and another hundredweight put on as a top-dressing after the feeding-off in the spring. The latter method is good practice after a wet winter when the crop is hanging fire and showing somewhat yellow.

The cultivation for autumn-sown cereal crops should provide a good mould underneath, but an endeavour should be made to leave the surface a little lumpy. These lumps shelter the young plants and prevent the surface from running too tightly together during wet weather; an even surface for harvesting can be provided by harrowing or rolling in the spring.

It is advisable to use oat-seed from the previous year's crop. Some oats, especially Algerians, have a very low germination until the normal ripening process has been gone through. Seed which germinates quite well twelve months from harvesting has been known to give only about 30 per cent. germination a few weeks after harvest. If year-old seed is not procurable and current season's must be sown a very heavy seeding should be resorted to. A normal rate of sowing for Algerian oats is from 2½ bushels to 3 bushels per acre.

LIMING AND TOP-DRESSING.

April is quite a good month in which to apply lime to the land, particularly for grassland that is to get a dressing of superphosphate in the winter. In the case of land intended for cropping the lime should always be put on the ploughed surface; it will work down quickly enough. If applied to a grass surface and ploughed under it quickly gets below the range of the roots of ordinary crops. Most land can benefit from a ton or more of lime per acre, but it is better policy to put on a smaller quantity, say, 6 cwt. or 10 cwt., and repeat at more frequent intervals, rather than put on a heavy dressing and then let it go for several years. There are, of course, exceptions, such as where the land is very sour. In such cases a heavy dressing must be given to show any results. For general purposes, and where it can be applied early in the year, carbonate of lime (ordinary ground limestone) is the best.

Many farmers, especially in the North, are in the habit of top-dressing their pastures in March with the object of producing late feed, though on the whole it is probably better practice to rely on supplementary forage-crops, and to rest the pastures during the winter

months. However, 2 cwt. to 3 cwt. of superphosphate applied now will stimulate a useful growth. The slower-acting manures, such as ground rock phosphate, can be applied with advantage in the autumn with a view to stimulating spring growth.

FEEDING-POINTS.

The feeding of maize, millet, &c., should be finished by the end of April, as the first severe frost cuts these crops back and generally reduces their feeding-value. Moreover, in dairying districts the cows will be drying off about the end of the month, and should go on to hard turnips, swedes, or good pasture. Autumn is the time to feed the cows up and put them in good condition to produce a healthy calf and do their best at the bucket next season. If allowed to go back at this period no amount of extra feeding later in the winter will bring the cow forward in the spring in the best condition. In-calf heifers should also have special care at this time.

The popularity of Japanese millet throughout the Auckland Province and some other North Island districts has been amply demonstrated this season, and undoubtedly many thousands of pounds have accrued to dairy-farmers from its use as a drought insurance. In many cases, however, waste has resulted from allowing the crop to get too far ahead of the stock. Millet is at its best for grazing when about seven weeks old or 8 in. to 10 in. high. The cows then relish it keenly and subsequent growth will be rapid and even. Millet has also proved itself good grazing for lambs, and should be valuable for flushing ewes at mating-time.

As regards the feeding of green crops (barley, oats, &c.), in order to prevent waste from undue trampling of the crop it is better to make two or three feedings-off when the growth is not excessive rather than wait until a large bulk of feed is present. Besides the saving of waste the fodder is more palatable when not too much grown.

IRRIGATION OPERATIONS.

On irrigated areas in Central Otago preparations should now be made to have contour ditches cut, leading water to those places in the various paddocks which during the past season have proved hard to irrigate. This particularly applies to undulating country. Low-lying parts of the paddocks which become flooded during the irrigation season should have open drains cut, so as to allow surplus water to be carried off to lower levels. Ditches can now be cleared while still soft, and all boxes which have become disrepaired during the season should have attention.

The breaking-up of land intended for spring sowings should be pushed on without delay, before hard winter frosts make cultural operations difficult.

SUNDRY HINTS.

Pastures, both permanent and temporary, may still be sown in April, but if the situation is at all exposed it is advisable to sow a bushel of white oats or barley with the grass-seed to provide temporary shelter.

On the better soils probably no better nitrogen-fixer can be grown than vetches, and their importance as a hay crop cannot be too strongly

stressed. The crop, whether for seed or for hay, should be got in by April. Oat and vetch hay is highly palatable and relished by stock. Rates of sowing were given in last month's notes.

Where necessary preparation for drainage should now be made. The levels can be taken and the lay of drains determined, so that when time permits the actual work may be carried out. The mouths of all drains should be also attended to and put in good running-order before winter sets in. It is a good plan for a farmer to have a sketch of his farm, showing each field, and where watercourses and drains are situated.

In all cases stacks should be raked and made secure, and when not intended for immediate use they should be thatched. Where not already done stacks should also be fenced without delay, as stock will be acquiring a keener appetite for dry fodder, and can do a considerable amount of damage in a short space of time.

The tripod-harrowing of cow pastures at this time of year allows the solvent action of the rain to make available a well-distributed and valuable manure.

—Fields Division.

THE ORCHARD.

MARKETING.

THE principal work to be undertaken by the fruitgrower is the gathering of the later varieties of apples and pears. By the time these notes appear stone-fruit will be practically finished, while apples and pears will continue for a considerable time yet.

Each variety as it develops and matures should be dealt with. Every grower should have a clear idea of what he is going to do with his fruit before he gathers it. The reason for this is obvious, as it will in many instances determine the time for picking. Where midseason varieties of apples are required for local markets they should be allowed to reach the full maturity stage previous to picking. If this is done the fruit will practically always command a good price; whereas if fruit is picked before it has reached that stage of maturity when it gives the best flavour and presents a good appearance it will suffer in value. It is always well to bear in mind that the expenses of marketing are practically the same for both classes of fruit; therefore the grower should aim at securing the maximum return for his labour by marketing his fruit in a proper manner. When fruit opens up in the pink of condition it sells itself, whereas when it is in poor condition it is hard to sell on any market.

AUTUMN SPRAYING.

Where woolly aphis is very bad no time should be lost in spraying for its control, using either Black Leaf, 40, 1–800, plus 3 lb. soap to every 100 gallons, or red oil, 1–60. In some localities, should the weather conditions continue dry, it may still be necessary to make a late application of arsenate of lead for the control of codlin-moth and leaf-roller caterpillar. There is always a danger of leaving off this spraying at too early a date, a late infection being the result.

COVER-CROPS.

Where cover-crops are required and have not been sown no time should be lost in having the work carried out, as the growing-season will soon be past. Lupins, peas, and vetches all make good crops for ploughing-in. This is a splendid way of adding organic matter to the soil where it is lacking.

PLANTING.

Where planting is contemplated during the coming winter there should be no delay in ordering the different varieties required, as it is often difficult to obtain them later in the season, and often much dissatisfaction and inconvenience is caused, whereas by a little forethought this could have been obviated. It is also well to remember that land needs to be thoroughly prepared beforehand if the best results are to be obtained. An early start should therefore be made by ploughing up the land for the first time, which will give an opportunity for all growth to decay. The soil will also be sweetened by this process, and will be in a much better condition to receive the trees than if ploughing is left until the winter. In some localities planting can be done (given suitable weather and soil conditions) towards the end of May or early June. However, unless conditions are very favourable it is better left till about August.

—L. Paynter, Orchard Instructor, Christchurch.

CITRUS-CULTURE.

There appears to be every indication that the autumn blossoming will be below the average, but slightly earlier than is usual. Immediately the blossom petals have fallen from this blossoming it will be necessary to put on an application of bordeaux, 4–4–40, for the control of fungoid diseases generally. Where *Lecanium oleae* (brown scale) is still causing trouble on citrus-trees a further application of red-oil emulson, 1–40, may be applied about three weeks after the bordeaux is put on. As pointed out in previous notes, high-pressure power is most essential for the successful carrying-out of this work, as the citrus-trees require very careful attention if they are to be efficiently sprayed. Too little attention appears to be paid by some growers to the destruction of infected fruit—that affected by verrucosis, brown-rot, or blue mould (*Penicillium*). On no account should this diseased fruit be allowed to lie about in or around the orchard; it should either be completely removed, or buried to a sufficient depth to preclude the possibility of the spread of spores from it.

FIREBLIGHT.

Owing to autumn weather having set in considerably earlier than is usual it is not considered likely that there will be any further infection of this season's growth from fireblight on either apples or pears in the Auckland District. As previously stated, the position is entirely satisfactory at the present time, as far as those areas situated within the boundaries prescribed by the Fireblight Act, 1922 (Second and Third Schedules), are concerned.

—J. W. Collard, Orchard Instructor, Auckland.

POULTRY-KEEPING.

MANAGEMENT OF THE PULLETS.

PULLETS should now be in their permanent winter quarters, especially birds that are nearing the laying-point. Changing of the quarters at this stage is a common cause of the birds going into a moult with the adult flock, thereby causing a loss of winter eggs. Any sudden change of food will also have this undesirable effect.

It will thus be seen that uniform treatment in all things pertaining to the management of the pullets at this period of the year should be the watchword of the poultry-keeper. On no account should pullets be forced to prematurity with rich foods such as meat, milk, &c., until good bodily development has been attained. At one time it was a commonly held opinion that the bird to mature first was the most profitable to keep, but this does not hold good to-day. It is common to hear breeders boasting that their particular strain of birds commence laying at four and a half to five months old, and sometimes younger. This may be quite true—indeed, I have known of pullets that started to lay before thay reached four months. But of what advantage is this when nothing but a second-grade egg can be expected from them? Besides, such stock are next to useless for breeding purposes by reason of being undersized, which necessarily goes hand-in-hand with prematurity. To force a pullet to prematurity is about as sensible as the common practice of breeding from specimens that are devoid of breed-type and producers of small eggs, merely because they have some ancestral egg-record strain behind them.

THE SIZE OF EGGS AND BREED-STANDARDS.

As things point there is every prospect of the Dominion establishing a sound overseas trade in eggs. To achieve this nothing less than a 2 oz. standard egg is required, and it is not the altogether-too-commonly-seen diminutive White Leghorn than can be depended upon to produce this desirable exportable article.

It is commonly agreed by old fanciers—the men whom we have to thank for developing the breeds of poultry at our command to-day—that the good big bird is always better than the good small one. True, the fanciers (and perhaps more so the judges) often made mistakes by aiming for birds of extreme size and those possessing exaggerated show points, such as heavy combs, long legs, loose feathering, &c., at the expense of the egg-basket. Unfortunately, however, too many utility breeders are going to the extreme in the other direction. While the great merit of many strains of White Leghorns we possess is undeniable, still there is a tendency for the average flock to become smaller and smaller each year, as well as the eggs they lay. In addition there is a general lack of breed-type.

I have long contended that striving for heavy egg-yields and ignoring breed-type and general standard requirements would ultimately bring about the ruination of many strains. This contention was fully borne out by the fact that the bulk of the eggs which came forward for the recent trial export shipments failed to turn the scale

at 2 oz. In view of this it has been suggested that the 2 oz. standard is too high, and that a grade for $1\frac{3}{4}$ oz. should be established. The argument used in support of this is that too many small eggs have to be handled in order to select sufficient of the 2 oz. product. Of course, this is a weak argument in view of the fact that a name for New Zealand eggs has been made on the London market by the initial shipment of 2 oz. eggs. The proposal, indeed, suggests itself as trying to foster the industry on the one hand and to kill it on the other. In a general way the $1\frac{3}{4}$ oz. egg would cost as much to land on the London market as the 2 oz. one. The freight, the case, the fillers, &c., would be about equal in cost. Thus by shipping the lower-grade article a non-payable price would probably be returned to the producer, to say nothing of the risk of loosing the good name we have already established.

Rather than lower the grade the poultry-keeper should mend his methods of breeding and management, so that at least the great majority of his flock will produce 2 oz. eggs, a size which is so much desired on the London market. Just as the number of eggs can be increased by careful breeding and selection, so can the size of egg be increased by the same process. Of course, the man with a small-egg flock is in a happy position so far as the local trade is concerned, as under the present crude system of pooling he gets a similar price for his $1\frac{3}{4}$ oz. eggs as the man with a 2-oz.-producing strain. In the latter size there is practically 3 oz. more food in each dozen—in other words, a difference of one and a half 2 oz. eggs to the dozen. Thus it will be seen that the consumer invariably, if not always, pays too much for small eggs and not enough for large ones. On the London market it is entirely different. Eggs are paid for according to their weight and quality, and the sooner this is realized by the producer the sooner will our export trade be placed on a sounder footing. The small-egg question is one of the most important problems facing poultrymen to-day. Utility poultrymen generally will be well advised to give more attention to the maintenance of breed-type than hitherto.

Reference has again and again been made in these notes to the value of poultry shows as a means of preserving the correct type of the various breeds at our command. The illustrations in the Dominion Utility-poultry Standards afford a splendid guide as to the best types to breed from for the production of uniform flocks, and which can be depended upon to lay the standard weight of egg so much desired for the overseas trade. With the prevailing tendency I can see a great revival of the type aimed at in the Utility-poultry Standards, as well as a general realization that poultry shows are of equal importance for the welfare of the industry as are the egg-laying competitions—the one being a corrective of the other. Beauty and utility are not inseparable, but in the absence of show competition this fact is apt to be ignored if not lost sight of altogether.

While the striving after extreme egg-production has reduced the value of many strains of White Leghorns by bringing about deterioration in size of fowl and egg, it is gratifying to know that there are still strains in the Dominion which retain the needed size, stamina, and power to produce good numbers of first-grade eggs. The warning, however,

is there that there is a limit to which we can go in the laying-capacity of a bird, and if phenomenal layers only are looked for the strain will suffer in constitutional vigour and size of bird and eggs.

LEG-WEAKNESS IN YOUNG STOCK.

Many complaints have reached me of young birds developing a weakness in the legs, and in each case the cause has been traced to too close confinement accompanied by very liberal treatment. There is here a close analogy to the hothouse plant—a rapid development but lacking in substance. For the maintenance of a healthy, vigorous flock it is essential that the young stock should be reared in the most natural manner possible, without, of course, subjecting them to extremes of weather. This implies good comfortable housing. In addition they should be fed well from first to last. There is, however, always the risk that this needed care may unconsciously develop into pampering, and the coddled bird is a menace. Plenty of fresh air and exercise will always be the fundamental requirements in raising heavy-producing stock. The modern high-type layer is an artificial product, but if she is to be bred to the profitable standard to which human wit and experience have brought her the demands of nature must be observed. The higher the type of the animal the greater is the need to provide against the weakening influences of close confinement and lack of exercise.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

PREPARATION FOR WINTER.

THE time is at hand when it is of paramount importance that proper preparation be made for winter. If the colonies are to winter in good order, so as to escape the abnormal losses which sometimes occur, then it behoves the beekeeper to attend to the leading factors that produce successful wintering. The attendant evils of neglect are starvation, spring dwindling, and poor colonies, these latter being of little account when the next season's flow arrives.

Among the most important factors which make for success are a strong cluster of bees, a good queen, plenty of good stores, and protection. It is safe to say that too little attention is paid to wintering the colonies with strong clusters of young bees. Having secured a crop of honey, and noting that the colonies are strong in bees, the beekeeper is satisfied to trust to chance. At the close of the season the colonies are likely to contain a large force of bees, but the majority, having helped to gather the season's crop, are old, and in consequence cannot be taken into account in wintering. As a result, unless large numbers of young bees are being raised to take the place of the old bees, the colonies will seriously dwindle in the spring or become a total loss in the winter. Every effort must be made to keep up breeding well into the winter, and it is often advantageous to stimulate the colonies by autumn feeding.

Next in importance is the necessity for the colony to be headed by a good queen. Too little attention is paid to superseding failing queens. A queen that has laid vigorously during the honey season is likely to become worn out and her powers of reproduction diminished. In all cases these queens should be replaced and a vigorous young mother supplied. It often happens that the bees recognize a failing queen, and set to work to supersede her, but this work should be anticipated by the beekeeper. Other things being equal, stocks headed by a vigorous mother are likely to keep up late breeding, with a result that the colonies will come out in the spring with a prolific queen, and the loss attendant upon queenless hives will be greatly diminished.

If the beekeeper studies his interests and the welfare of his bees he will ensure that every colony goes into winter quarters with plenty of good stores. This is a most important factor, and upon it depends largely the staving-off of starvation which faces the bees during the months which follow. The colonies that are supplied with honey winter safely, build up early in the spring, and are ready to take advantage of the nectar from the early-flowering plants. Beginners often ask how much honey should be left for the bees to winter on. The amount necessary must to some extent depend largely upon locality, and care must be exercised, more particularly in the South, to provide sufficient food so that winter feeding may not have to be resorted to. In the North winter feeding may be successfully carried out, as there is not the same risk in breaking up the clusters as there is in the extreme South. As mentioned last month, in no case should a colony be left with less than 30 lb. of sealed honey, and it is wise to increase this amount to 40 lb. Abundance of stores is essential if winter losses are to be eliminated altogether.

Another important factor in safe wintering is that of protection. This may be provided by housing the bees in good watertight hives and protecting them by good shelter-hedges or fences. Great winter losses occur every year in this country through lack of attention to the hives, more particularly to the roofs. Leaky roofs are an abomination, and should not be tolerated under any circumstances. By allowing the roofs to leak the mats and hives become damp, and the consequent drain on the stores is largely in order to keep up the heat of the cluster for safe wintering. It is safe to state that where the bees are kept dry the amount of food consumed to keep up the heat of the cluster will be small as compared with the stores eaten where proper protection has not been afforded by the beekeeper. New Zealand in general being a wind-swept country, it behoves the beekeeper to see that the bees are located in a sheltered position. Cold winds militate against brood-rearing, and also prevent the bees from taking a cleansing flight during the spring months.

MARKETING THE CROP.

Before the honey is finally run out of the tank the beekeeper should have decided on which market he intends to place his product. If export is his aim the matter is comparatively simple, as only large packages are required; but where the local trade is to be catered for it is wiser for the beekeeper to put the honey up into small packages

himself. Rehandling means remelting, and unmelted honey is the better article. In addition, if the honey is not to be sent overseas the producer owes it to himself to sell it under his own name and trade-mark. This will soon prove the best form of advertisement, and, coupled with a reputation for care and cleanliness, should ensure quick sales and good prices.

Everything should be done to make the article as attractive as any other food product, and proportionately as much care given to the intricate result of beekeeping as to the bees themselves. The Sale of Food and Drugs Act requires the honey-producer to label his packages and to state thereon the contents and weight. Apart from this requirement being a necessity as representing a fair deal with the consumer, it has also done good work in disposing of old-time haphazard methods of marketing, and has helped to force on bee-keepers the necessity of studying the commercial side of the industry.

CARE OF COMB HONEY.

There are factors in the proper treatment and care of comb honey which the producer is apt to overlook when putting his honey on the market. Usually the practice followed is to despatch the crop to market, where it is sold, to be afterwards graded and cleaned by buyers who are alive to the demands of the local market. These buyers obtain a better price by grading and cleaning the comb honey, whereas the producer can by employing proper methods demand an increased price.

Comb honey should be fully capped before removal from the hive, and it should not be left until its white appearance is destroyed by travel-stain, this being caused by the constant traffic in the hive. When the sections are removed they should be stored in a warm, dry room, as low temperatures hasten granulation, and granulated comb honey is not likely to meet with ready sale. Moreover, comb honey stored in a cold, damp place is apt to "weep" (or absorb moisture from the atmosphere), forming beads on the surface of the comb, which in the course of time becomes sour, thus destroying its marketable value. As opportunity allows, the sections should be cleaned of all propolis and stain; this is best done by scraping the sections with a knife, and the operation finally completed by sand-paper. Care must be exercised not to damage the cappings of the comb and thus destroy its attractiveness.

Before forwarding the honey to market it should be carefully graded, and finally packed in cartons. By the use of cartons the sections are secured from dust and insects, and present an attractive appearance when offered for sale, besides being far less liable to breakage. In order to ensure safe transit excellent shipping-cases can be purchased from the hive-dealers. These cases are fitted with corrugated paper cushions, which materially reduce the breakage from rough handling. A feature of these section crates is a sliding-cover which enables the honey to be readily examined. The crates are appreciated by the retailers, and at the same time help to increase the average price to the producer.

—E. A. Earp, Senior Apiary Instructor.

THE GARDEN.

VEGETABLE-CULTURE.

HARVESTING and storing the crops will be important work during April. After the dry summer experienced in most localities the potato-moth is likely to be troublesome. Its depredations will be prevented to a large extent if care is taken to bag up all potatoes dug each day, and so avoid leaving any on the ground overnight on which the moth may deposit its eggs. Potatoes that have grown near the surface of the ground are likely to be infected, in which case they should not be placed in the bags with sound tubers.

The most serious losses in this and other crops are the result of storing mixed grades. It is of first importance that only a perfectly sound sample should be put aside for long storage. All defective, broken, and small types should be graded out for immediate use. The best storage conditions for tubers and the like are those which exclude moths and vermin, that are dark and with an even temperature and ordinary atmospheric humidity. Under such conditions if the product is ripe and well harvested there will be only small losses.

Cabbage, cauliflower, and lettuce plants sown in the previous month should now be planted out on a piece of clean well-prepared land in an open situation.

Celery should be earthed up as advised last month where this operation has not been completed. In a sheltered well-drained situation form seed-beds of main-crop cabbage, summer and autumn cauliflower, onions, and lettuce for planting out in early spring.

SMALL-FRUITS.

After the preparation of the land it is most essential that strong clean plants be planted. Raspberry-canes are sometimes obtained from a nearby grower. Before definitely placing the order it is well to visit the plantation and see that the canes offered are, as mentioned, clean and strong. Currants—black, red, and white—are in fair demand, as also are gooseberries. Intending planters are recommended to carefully go into the question, and place their order early where satisfactory plants can be obtained.

While it is necessary to avoid working the land when it is wet, the opportunity should be taken, whenever the land is dry, of putting the hoe through these sections, more especially the newly planted strawberry-beds.

THE HOME SURROUNDINGS.

The present is a suitable time to attend to the trimming of hedges, clearing open drains, and gravelling paths—attentions that go a long way towards enhancing the comfort and appearance of a garden. The garden hedge is usually allowed to grow too wide and top-heavy. It has a better appearance if kept narrow, and the top a little more so than the base.

In the warmer situations new lawns will come away very quickly; while it is undesirable to let the new grass get too long, it is still less

desirable to cut it too short. Occasional attention with a mower that is sharp, properly adjusted, and set high is the best treatment at this season.

The time is now approaching when the planting of evergreen and deciduous trees and shrubs may be carried out. One often sees expensive and beautiful trees planted that fail to grow, or should they grow the results are disappointing—a result that is usually due to an unsuitable environment. Successful effects are readily obtained if the local conditions are studied, together with the conditions preferred by the different shrubs. For example, a house on a sandhill in a locality with a low rainfall is a most discouraging site for a garden; yet there is a local instance in which by means of concrete paths, ice-plants, cacti of many different kinds, and the popular *Romneya Coulteri*, &c., a flourishing, beautiful, and curious garden is the result. Every plant there is a native of such conditions, and requires little encouragement to make it flourish. On rather hilly country with an acid soil rhododendrons, azaleas, heaths, and such plants flourish naturally, and will give effects unequalled by similar plants elsewhere. It is from this point of view that the planter should usually study the subject, for where this is done not only is the garden approved, but it also harmonizes with the outside environment.

—W. C. Hyde, Horticulturist, Wellington.

HIGHLY GROUND NAURU PHOSPHATE.

At the meeting of the Board of Agriculture this month the President informed the Board that it had come to his notice that some top-dressing experiments with very finely ground phosphate rock derived from Nauru and Ocean Islands were being carried out in Victoria, with good results. He had been able to secure a sample of this finely ground material which was submitted to the Department of Agriculture and reported upon by the Department's Chemist, Mr. B. C. Aston. The latter advised that the phosphate rock was ground very finely indeed, having passed through a mesh 120 to the linear inch, and as a result it was in a more available form than the ground Nauru phosphate usually on the local market (100-mesh). It is proposed that the Department shall carry out some experimental work in the Dominion with similar highly ground material.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 1st March: *Peas.*—Arrivals of Japanese blue continue heavy and spot market is somewhat depressed. Japanese on passage have been sold at £21 10s. per ton c.i.f.; February–April shipments, £22. Tasmanian blue offered at £20 c.i.f., February–March shipments, but buyers' idea about £19 10s. New Zealand blue, slow sales for spot at £17 to £19. New Zealand partridge worth about 75s. per 504 lb. c.i.f., but sellers asking 77s. 6d. for March–April shipments. Maple ex store at nominal values; Tasmanian, 90s. to 95s.; New Zealand, 73s. to 75s.; Tasmanian afloat, sellers 90s., buyers 87s. 6d.; February–March shipments, sellers 86s. 6d., buyers 85s. *Beans.*—English old winter crops sold up to 56s. per quarter; spring crops, 65s.

New Rabbit District.—The constituting of the Kihikihi Rabbit District (South Auckland) for the purposes of Part III of the Rabbit Nuisance Act is gazetted.

THE HAGUE INTERNATIONAL CONGRESS ON CATTLE-BREEDING, 1923.

THE International Congress on Cattle-breeding convened by the Netherlands Government, and held last year at the Hague, was attended by some 155 delegates representing thirty-six different countries. The proceedings largely covered the field of stock-breeding and feeding generally, while the subject of tuberculosis among cattle was also dealt with. New Zealand was represented at the Congress by Mr. R. McGillivray, of the Department of Agriculture, who was at that time in Europe. The following matter is from a brief report furnished by Mr. McGillivray :—

The Minister of Agriculture (Hon. C. J. M. Ruys de Becrenbrouck) opened the Congress, and emphasized the point that in almost all countries stock-breeding forms an important source of revenue, and the national prosperity is closely allied to this branch of agriculture. In all parts of the world competent persons are engaged in breeding stock, and many of these apply scientific knowledge, but still we find we are to-day to a very large extent working in the dark, and much remains to be done before we can hope to attain that measure of success that is desirable.

The object of the Congress was stated to be to bring together representatives from the principal agricultural countries of the world for the purpose of obtaining an exchange of views and ascertaining the various methods of breeding, feeding, &c., in the different countries. It was felt that now that world relations have become somewhat normal and meetings of an international character are possible, it is a matter of very great importance that the scientific currents that have developed in the different countries, in the stock-breeding sphere, should run concurrently, so that in this way the views of each should be tested, and that there should be a general exchange of ideas. It was very noticeable that this Congress was not one in which certain delegates came full of ideas and theories which they were anxious to impart to their fellows. The feature of the sessions was the fact that all seemed to be searching for information, and seeking means to turn aside the veil of mystery that enshrouds some of the fundamentals of the art of breeding.

The statement was made that breed-improvement is now at something approaching a dead end, because there are comparatively few men who fully understand the art of breeding even as at present recognized, and that being the case many are inclined to leave further breed-improvement alone. It was pointed out that even supposing this to be true, there are in all countries successful breeders and scientific men whose services are available as research workers. Many of these may not be fully experienced, but if we fail to make use of the human material at command in a case like stock-improvement, where, speaking broadly, little is known, then the world may wait for centuries before the intricacies of breeding emerge from their present obscurity. Encouragement should be given to all workers, and thus the spirit of progress will be kept alive.

It was pointed out that there can never be such a thing as absolute perfection of type. In the past a system of inbreeding aided by careful selection has given us the stock we have to-day. Breeders in most cases simply set up a standard and mate stock accordingly. We have now, however, reached a stage when deep delving into the laws that govern inherited characters is necessary, and, as mentioned at the Congress, this can only be done under something approaching experimental farm or college conditions. It is a slow and costly undertaking which can be carried out only at a State or an endowed institution.

It was mentioned that the organization of research in Great Britain as applied to agriculture may be said to date from the appointment of the Development Commission, in 1909. Prior to that date agricultural research was unrecognized by the State. If this research movement is to be kept alive it must continuously be kept in contact with the business of farming. To divorce

research from the farm and the farmer is to cause the farmer to lose faith in scientific investigations. He must be kept advised by means of progress reports as to the work in hand and results obtained, and their practical application to the farm.

It was pointed out that selection in breeding signifies nothing else than making use, in practice, of the laws of nature with regard to heredity. Ample knowledge of the results of the laws of heredity that have been recorded is therefore of especial significance for the breeder of stock, and the utmost importance must be attached to the results of investigations with respect to heredity as set out in the mutation doctrine according to de Vries, and also the teachings of Mendel and other investigators.

What is known so far concerning mutation shows us the extraordinary importance of the single individual in selection, and the necessity of determining its breeding-value by means of the progeny and their performances. Mendel has shown that every factor of heredity behaves, in the process of heredity, perfectly independently, and that, on crossing, the introduced hereditary factors in the succeeding generations are subject, according to fixed laws, to a splitting-up process. It is the generally accepted idea that it is not the type of animal as such that is inherited. The disposition of characteristics does not form one whole in the process of heredity, but the separate factors take their own course. The doctrine of heredity has an exceptionally lasting influence upon the mode of thought and outlook of the breeder, and upon the judgment of the results of breeding.

The views of the Mendel doctrine give the breeder valuable general particulars and points upon which to go in carrying on selection in breeding; but knowledge concerning the nature and the conduct of the definite factor of heredity is still a matter of pure surmise, and therefore it is recommended that further research on this point be undertaken.

It is in the interests of the economic breeding of domestic animals to investigate in all directions the question of heredity by supporting new or established institutions for biological research, and herd-books should be available for investigations of heredity. The analysis and investigation of the characteristics of heredity in our breeds of cattle must be based primarily on the particulars contained in the herd-books. As the desire for breed-improvement is world-wide it is therefore desirable that herd-books should be compiled according to a common international plan, so that particulars from individuals should be similar irrespective of location.

For the purpose of breed-improvement close co-operation is necessary between science and practice. Science must develop the particulars ascertained from practice, and practice must reciprocate and thus pave the way for the success of both.

The breed societies should have registered all animals that do not deviate from the race, and the breeding results should be available to breeders. The organization and holding of fairs and shows should not be considered so much as a competition, but more as a means of gaining experience and educating the people. Efforts should be made to ascertain the external circumstances that exercise an influence upon the development and retention of characteristics in domestic animals.

In considering how public authorities could assist in promoting stock-breeding Dr. Attinger (Germany) mentioned that in all civilized countries such breeding enjoys State encouragement, and it might also be said that the height of the development of stock-breeding is a standard for judging the civilization of a nation. In this connection it was pointed out how intimately connected were the cultivation of crops and stock-breeding, as without pastures and fodders no stock could exist. It was therefore necessary for stock welfare that fodder-crop development should receive public encouragement.

The establishment of Government model breeding-farms was advocated for the purpose of developing good stock, as it was a fact that mongrel stock were in all countries a source of serious loss. Such model farms should be quite independent of the ordinary State experimental farms, and should not be set up in a manner which could not be emulated by breeders, but the establishments

as regards equipment, manner of working, and profit-making should be examples capable of being followed by all breeders.

The task of model breeding-farms would be to produce choice strains of stock with hereditary qualities on such conditions as are most suitable to their perfect preservation. In proportion as the individuals of the male line from these choice strains become available they should be placed at the disposal of farmers' societies, and if this were done the "scrub" bull could in a comparatively brief period be eliminated by legislative action.

In the session dealing with the science of feeding it was apparent that eminent scientists like Professor Mollgaard, of Copenhagen, and Professor Isaachsen, of Christiania, were very far from satisfied with the present position and knowledge regarding animal nutrition. It was said that in countries where pasturage is available for seven or eight months in the year it is doubtful if the matter of animal nutrition as placed before the agriculturists of the colder lands of the earth will ever be seriously considered, for good pasturage is the best and cheapest food that can be given to stock, and if plenty of suitable fodder-crops are grown in the climatically favoured countries for use when the grass is not abundant, it is likely that this would fully meet the need without the use of expensive concentrates of often doubtful quality. It was also mentioned that many of the theoretical feeding experiments and results obtained have utterly failed to work in practice.

It was, however, the desire of the Congress that the work of investigation in this branch should be encouraged as far as possible.

The session devoted to tuberculosis among cattle—one of the most serious problems confronting breeders in Europe—was of a very interesting nature. The significance of the disease lies in its great prevalency, and in the fact that it hinders the economic use of many animals and costs immense amounts of money every year. The cattle-breeders are now favourable to and realize the necessity for measures being taken against the spread of the disease. The Congress appeared favourable to the principle of legislation granting payment of compensation for animals destroyed, but owing to the prevalence of the disease in some countries did not consider the time opportune to take the matter up.

It was held that for the promotion of greater security for stock-breeders, and in the interests of the production of clean milk, a continuous effort is necessary having for its object the reduction of tuberculosis to the very smallest possible proportions. Irrespective of other considerations prompt measures must be taken for the eradication of infection-distributors. The use of tuberculin not only facilitates the campaign against the disease, but is indispensable.

Though the virulence of the bovine tuberculosis bacilli is very great in cattle, and it has been found that susceptibility to tuberculosis increases correspondingly with the development of breeding for milk-production, still it is satisfactory to know that many herds of heavy milkers are quite free from the disease. It was pointed out that even in regions where the disease is extremely common only from 0·3 to 1 per cent. of new-born calves are affected with congenital tuberculosis. In order to avoid infection healthy animals must not be allowed to remain in contact with diseased ones, and raw tuberculous milk must not be fed to animals.

FORTHCOMING AGRICULTURAL SHOWS.

Mayfield A. and P. Association: Mayfield, 22nd March.
Methven A. and P. Association: Methven, 27th March.
Temuka and Geraldine A. and P. Association: Winchester, 3rd April.
Manawatu and West Coast A. and P. Association: Palmerston North (Winter Show), 17th, 18th, 19th, and 20th June.

(Agricultural and Pastoral Association secretaries are invited to supply dates and location of their shows.)

RURAL LAND-HOLDINGS IN NEW ZEALAND, 1922-23.

HOLDINGS OUTSIDE BOROUGH BOUNDARIES CLASSIFIED ACCORDING TO SIZE, AND SHOWING AREA UNDER CROP AND LIVE-STOCK.

Size of Holdings (Acres).	Number of Holdings.	Total Area (Acres).	Area cultivated (Acres).	Horses.	Cows and Heifers over Two Years Old for Dairying.	Total Cattle (including Figures in previous Column).	Number of Sheep shorn, Season 1922-23.	Number of Lambs tailed, Season 1922-23.	Pigs.
1-5 ..	10,232	30,292	3,138	5,188	9,589	13,416	1,302	827	3,999
6-10 ..	5,218	42,781	7,213	4,753	11,297	16,733	981	439	6,298
11-15 ..	2,854	37,167	7,059	3,178	8,560	13,402	2,679	554	5,063
16-20 ..	2,375	43,832	8,239	3,124	9,359	14,710	1,134	495	4,974
21-30 ..	3,303	84,954	15,408	5,095	17,909	29,552	6,150	2,791	8,138
31-40 ..	2,501	90,653	14,184	4,586	19,513	31,612	6,233	4,800	8,974
41-50 ..	2,997	140,647	21,193	5,907	32,766	52,215	19,082	7,895	13,607
51-75 ..	5,333	334,568	51,401	12,794	78,171	125,258	30,569	17,261	28,792
76-100 ..	6,060	547,188	74,497	17,106	117,051	187,278	59,254	37,005	38,501
101-150 ..	8,036	999,253	136,823	27,020	191,883	310,696	144,506	97,301	60,333
151-200 ..	6,157	1,094,912	140,675	24,534	155,503	270,920	271,833	191,129	45,257
201-250 ..	4,283	962,667	128,934	19,573	109,712	202,841	316,288	226,221	31,707
251-320 ..	4,578	1,307,918	162,828	22,265	104,425	215,708	569,497	393,815	30,046
321-400 ..	3,756	1,359,628	151,967	20,030	79,744	184,711	708,852	492,818	23,357
401-500 ..	3,369	1,521,339	154,433	18,887	66,432	181,797	861,001	584,471	19,483
501-640 ..	3,290	1,864,896	163,230	19,446	56,627	184,823	1,203,677	782,042	16,616
641-750 ..	1,623	1,124,945	88,258	10,459	27,705	102,366	766,808	486,150	7,606
751-1,000 ..	2,636	2,303,683	140,856	17,586	39,021	191,558	1,545,376	957,150	12,167
1,001-2,000 ..	3,840	5,338,900	222,527	30,702	57,201	401,756	3,975,345	2,223,670	17,785
2,001-3,000 ..	1,115	2,726,190	67,290	11,324	13,737	186,853	2,038,694	1,061,479	3,658
3,001-4,000 ..	557	1,937,244	41,064	7,090	7,644	126,902	1,443,889	762,398	3,056
4,001-5,000 ..	310	1,391,125	17,268	3,509	3,414	72,140	932,192	427,240	782
5,001-7,500 ..	387	2,327,592	23,613	5,734	3,460	114,221	1,526,514	690,437	1,143
7,501-10,000 ..	182	1,565,737	11,189	2,974	1,200	62,479	890,888	371,280	401
10,001-15,000 ..	192	2,350,919	11,087	3,104	1,684	57,869	886,228	351,265	382
15,001-20,000 ..	109	1,884,131	7,271	1,936	816	32,282	574,989	215,435	167
20,001-30,000 ..	90	2,219,606	5,034	1,334	1,289	21,522	539,200	202,603	302
30,001-40,000 ..	53	1,860,339	2,058	959	322	15,614	342,936	115,825	233
40,001-50,000 ..	24	1,090,144	2,614	325	123	4,499	150,097	41,767	24
Over 50,000 ..	59	5,069,922	6,276	1,461	551	17,560	583,750	141,265	193
Totals ..	85,519	43,653,163	1,887,627	311,983	1,227,608	3,446,290	20,400,544	10,887,828	393,104

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

MORTALITY AMONG PIGS.

E. P., Waituna West :—

Some of my pigs have died, and may have eaten some phosphorized pollard or poisoned rabbits. On examination I could not find any pollard or smell any, but a little smoky gas came out of the stomach. The fluid in the gall-bladder was just like iodine. When dying, the pigs panted but would not drink, and when dead became blotchy. They had been fed on sour milk and allowed to graze ; the weather was very hot. Kindly advise me if the above symptoms point to pollard poisoning or some other malady that is fatal to pigs.

The Live-stock Division :—

Judging by your letter we should say that your pigs did not die as the result of phosphorus poisoning. The smell of phosphorus should be quite distinct on opening the stomach, and if opened in a dark room the phosphorescent glow is immediately noticeable. The symptoms of phosphorus poisoning are evidences of pain, increased thirst, and vomiting and diarrhœa, followed by collapse and convulsions. The pig is particularly liable to digestive trouble if improperly fed, and the skin is readily affected, getting a blotchy appearance such as you describe. Your method of feeding seems to be unsuitable, and was probably the cause of the mortality.

DRAUGHT OF PLOUGHS.

A. J. TROTTER, Hillgrove :—

Could you please inform me which plough is the lighter draught—the New Zealand or the American type ?

The Fields Division :—

The draught of a plough is not very materially affected by the shape of the mouldboard. In the case of the American type of plough the furrow is cut and lifted and then shovelled over, giving a pulverizing effect. The colonial type with the long mouldboard gives resistance for a greater length of time, and finally a packing result which increases the friction. The difference may be aptly expressed by the fact that a short-mouldboard plough wears first on the breast, while a long mouldboard wears at the end of the board. The general opinion among experienced ploughmen and trade experts appears to be that there is little difference in draught between the two types, but that, if anything, the American is lighter.

FOWLS WITH FOOT TROUBLE.

M. B., Weraroa :—

Could you tell me the reason for fowls getting large red cushions between their claws, and the cure ? I have also a young Wyandotte which has the same higher up on the leg.

The Chief Poultry Instructor :—

Your birds appear to be suffering from corns. The chief cause of these is due to continuous hard pressure. High perches and a hard floor to alight on are a frequent cause of the trouble, while stony runs or pricks from thorns often bring it about. The perches should not be higher than 15 in. from the ground, and there should be ample litter on the floor. Prevention on the lines indicated is the best

way of dealing effectively with the trouble. As to the affected birds, I would recommend that they be not allowed to perch, and that they be provided with a soft bed of straw to sleep on. Painting the foot with iodine is a simple and often effective treatment. Repeat this daily for a week, while frequent dressings of vaseline should be applied, especially to the sole of the foot, in order to keep it soft, this being the place at which the trouble usually starts.

BURNING OFF DANTHONIA.

E. E. V., Waiotapu :—

Please advise as to the best season for burning off danthonia, tussock, &c.—that is, the season when the fire will do most good to the pasture and kill any scrub growing in it.

The Fields Division :—

The best time to burn danthonia is in mid-autumn, so as to secure a good palatable bite throughout the winter. At one time burning danthonia at this season was regular, but many experienced farmers now practise in autumn and winter heavy cattle-stocking of danthonia that has got away. This leaves the country good for sheep in the spring. If the land has much bracken on it late autumn burning should always be carried out, but where manuka is springing up it is often better to burn in September. Unless, however, the land has been understocked during the winter it will not fire readily in spring.

BURNING OF IMPORTED HAY, STRAW, OR CHAFF PACKING.

THE following regulations under the Stock Act, dealing with hay, straw, or chaff packing received in connection with goods imported from certain countries, were gazetted on 6th March and came into force on the same date. They are designed as an additional precaution against the introduction of stock-diseases into New Zealand.

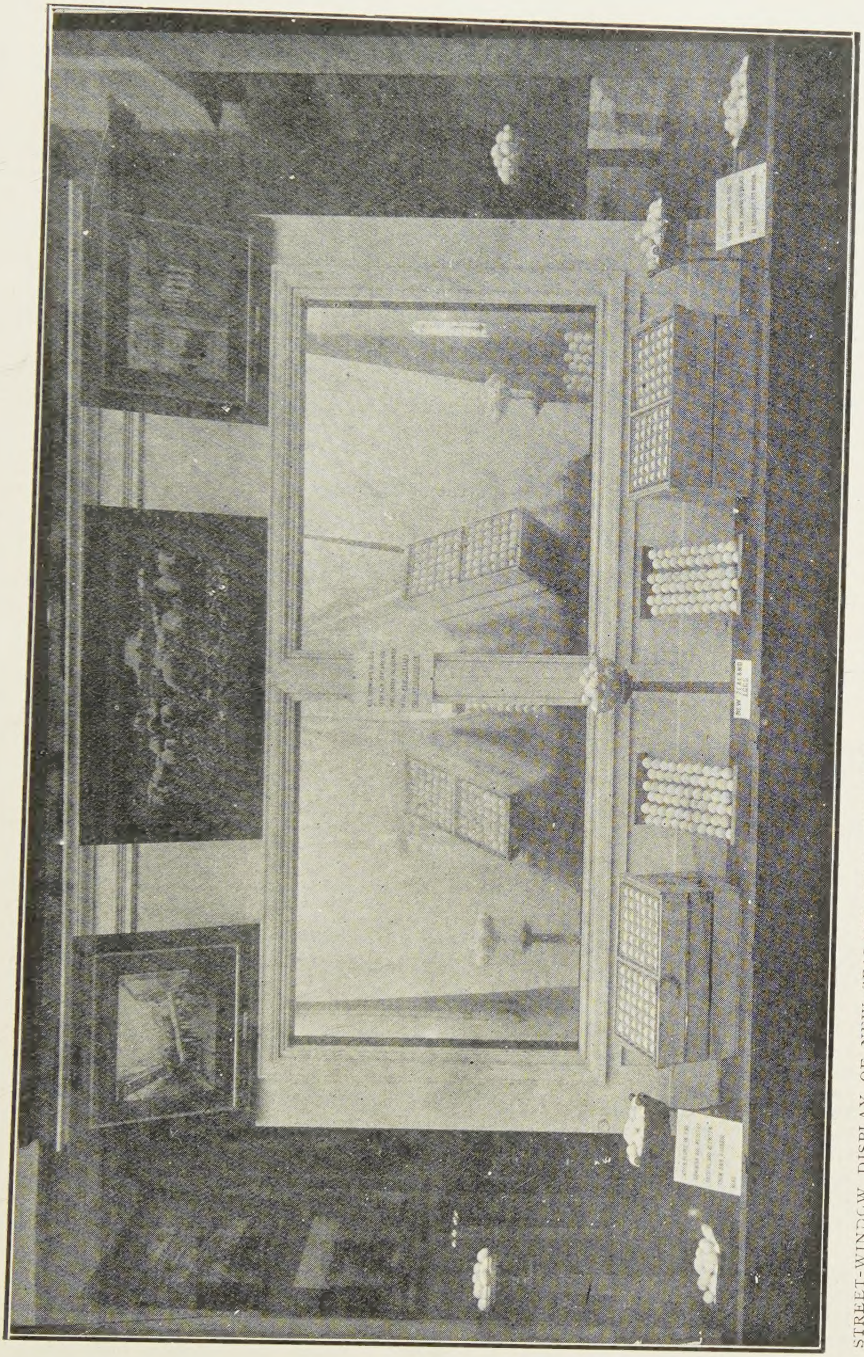
REGULATIONS.

1. In every case where goods of any kind are imported, either direct or by way of any other country, into New Zealand from Great Britain, Ireland, or any part of the Continent of Europe, or from the States of Queensland or Western Australia in the Commonwealth of Australia, or from the United States of America, and where any hay, straw, or chaff is received with such goods as packing or otherwise, the importer of such goods shall, with as little delay as may be, and in any case within three days of the commencement of the unpacking of such goods, thoroughly destroy all such hay, straw, or chaff by burning :

Provided that in the case of hay, straw, or chaff used for packing goods manufactured and packed in Great Britain the destruction of such hay, straw, or chaff will not be required if the packages are accompanied by a sworn certificate or statutory declaration from the exporter or packer, countersigned as correct by a responsible officer appointed by the High Commissioner for New Zealand for the purpose, to the effect that the hay, straw, or chaff used for packing had been disinfected prior to use, by steam, at 185 degrees for ten minutes, or by some other effective method approved by the High Commissioner.

2. In no case shall any importer use or suffer to be used any such hay, straw, or chaff (unless accompanied by a sworn certificate or statutory declaration of disinfection, countersigned as correct as provided for in clause 1 of these regulations) for repacking the same goods or for packing any other goods.

3. Every person who commits a breach of these regulations shall be liable to a penalty of not less than £2 nor more than £20.



STREET-WINDOW DISPLAY OF NEW ZEALAND EGGS FROM FIRST COMMERCIAL EXPORT SHIPMENT, AT HIGH COMMISSIONER'S OFFICE, STRAND, LONDON, NOVEMBER, 1923.

WEATHER RECORDS: FEBRUARY, 1924.

Dominion Meteorological Office.

GENERAL SUMMARY.

RETURNS to hand show that, with the exception of Canterbury, the rainfall in February was mostly somewhat above the average for the month in previous years. There were few atmospheric disturbances of much intensity or long duration. The month opened with a small westerly storm, but this was followed by anti-cyclonic conditions which prevailed for nearly a fortnight over the North Island. The latter part of the month was more changeable, owing to influences outside the Dominion. There was great warmth and high humidity, which conditions, rather than barometric changes, accounted for the rains that proved so generally beneficial to the country, especially about the middle of the month. The rainfall was often of a scattered or local character, probably owing to electrical conditions. Thunderstorms of note were reported in Southland, and accounted for some local rainfalls on the 12th and 15th. The dryness of the soil and the suddenness of the downpours prevented the rain soaking in, and left the country still in need of more moisture. Two westerly depressions also passed in the South on the 20th and 23rd, causing gales and rain. The same systems, however, were responsible for the nor'-westers in Canterbury and other parts of Otago.

—*D. C. Bates, Director.*

RAINFALL FOR FEBRUARY, 1924, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	5·54	7	2·84	2·95
Russell	2·44	9	1·15	4·35
Whangarei	4·73	10	1·42	4·95
Auckland	4·78	11	1·62	3·02
Hamilton	3·69	14	1·25	2·85
Kawhia	2·96	7	1·20	2·40
New Plymouth	4·46	9	1·64	4·09
Inglewood	7·56	10	2·42	6·30
Whangamomona	5·43	7	2·79	4·14
Tairua, Thames	2·72	7	1·70	4·52
Tauranga	2·93	7	0·97	3·73
Maraehako Station, Opotiki ..	5·40	12	1·72	3·70
Gisborne	1·83	8	0·72	3·68
Taupo	4·18	9	2·52	2·81
Napier	1·12	5	0·55	2·56
Maraekakaho Station, Hastings ..	1·69	3	0·93	2·52
Taihape	3·94	7	1·66	2·43
Masterton	3·92	7	1·84	2·71
Patea	5·10	8	1·72	2·33
Wanganui	3·32	5	1·97	2·49
Foxton	4·93	9	1·98	1·71
Wellington	4·24	10	1·76	3·18
South Island.				
Westport	5·97	12	3·05	4·37
Greymouth	5·12	12	1·05	6·13
Hokitika	5·48	17	1·38	7·20
Arthur's Pass	8·61	6	3·21	7·55
Okuru, Westland	9·40	14	1·80	7·92
Collingwood	11·55	10	3·82	5·03

RAINFALL FOR FEBRUARY, 1924—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	3·27	10	1·60	2·80
Spring Creek, Blenheim ..	2·84	6	1·75	2·30
Tophouse	3·44	9	1·39	4·50
Hanmer Springs	1·48	7	0·72	2·93
Highfield, Waiau	..	..	..	2·59
Gore Bay	1·09	5	0·62	3·50
Christchurch	0·45	6	0·26	1·84
Timaru	0·68	6	0·28	1·89
Lambrook Station, Fairlie ..	0·74	6	0·46	1·95
Benmore Station, Omarama ..	0·84	5	0·32	1·23
Oamaru	..	..	..	1·72
Queenstown	1·33	3	1·02	1·76
Clyde	0·96	7	0·33	0·99
Dunedin	1·37	8	0·65	2·69
Gore	2·70	11	0·83	2·47
Invercargill	2·46	12	1·02	2·68

HONEY-GRADING DATES, 1924.

THE following dates have been fixed by the Department for the grading of export honey at the respective centres:—

	March.	April.	May.	June.
Auckland	20	1	1	2
Wanganui		9	9	9
Wellington		12	13	13
Lyttelton		17	17	17
Timaru		21	21	21
Dunedin		25	24	24
Bluff		26	26	..
Greymouth		28	..	26

Producers are requested not to forward their honey to grading-store more than fourteen days prior to the date fixed in each case.

SHIPPING-FACILITIES BETWEEN VANCOUVER AND BRITAIN.

THE New Zealand Government Agent at Vancouver in a recent communication draws attention to the regular service of refrigerated freight steamers maintained by the Royal Mail Steam Packet Line between Vancouver and Great Britain via the Panama Canal, the passage occupying about forty-two days. The company is pushing the trade, and large quantities of apples from Canada and the United States have been shipped to British ports by this route. Trial shipments of butter to Britain have also been successfully made from Alberta, which province is rapidly expanding its dairy industry, and may at certain times have a surplus for export. The rate of freight on butter from Vancouver is $1.50 per 100 lb.

MEAT-FREEZING WORKS IN NEW ZEALAND, 1923-24.

Name and Address of Company. *Land District.*	Name and/or Location of Works.	Beef-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity in 60 lb. Carcases Mutton
North Auckland and Auckland.				
Auckland Farmers' Freezing Company, Ltd., Auckland	Moerewa ..	200	2,000	100,000
,, ,, ,,	Southdown ..	200	3,000	126,000
,, ,, ,,	Horotiu ..	200	3,000	66,000
Westfield Freezing Company, Ltd., Auckland	Westfield ..	200	3,000	205,000
R. and W. Hellaby, Ltd., Auckland	Westfield ..	120	500	3,000
East Coast Co-op. Freezing Company, Ltd., Whakatane	Whakatane ..	200	1,000	120,000
Hawke's Bay and Gisborne.				
North British and Hawke's Bay Freezing Company, Ltd., Napier	Westshore* ..	50	2,500	40,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch ..	Pakipaki ..	30	1,500	64,000
Nelsons (N.Z.), Ltd., Tomoana	Tomoana ..	80	4,000	175,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings ..	Whakatu ..	80	4,000	75,000
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa ..	Wairoa ..	100	3,000	165,000
Nelsons (N.Z.), Ltd., Gisborne	Waipaoa ..	150	4,000	270,000
Gisborne Sheep-farmers' Frozen Meat and Mercantile Company, Ltd., Gisborne	Kaiti ..	150	4,000	422,000
Ditto	Tokomaru Bay	60	3,000	140,000
,, ...	Hicks Bay ..	75	1,500	60,000
Taranaki.				
Taranaki Farmers' Meat Company, Ltd., New Plymouth	Smart Road* ..	125	2,000	160,000
Thomas Borthwick and Sons (Aus.), Ltd., Waitara ..	Waitara ..	200	2,000	82,000
New Zealand Bacon and Meat Packing Company, Ltd., Wellington	Eltham* ..	60	..	25,000
Patea Farmers' Co-op. Freezing Company, Ltd., Patea	Patea ..	120	2,000	180,000
Wellington.				
Wanganui Meat-freezing Company, Ltd., Wanganui ..	Castlecliff ..	100	2,200	100,000
New Zealand Refrigerating Company, Ltd., Christchurch	Imlay ..	200	6,000	271,000
Otaihape Farmers' Meat and Produce Co., Ltd., Taihape	Winiata ..	50	1,200	90,000
Feilding Farmers' Freezing Company, Ltd., Feilding ..	Aorangi ..	100	4,000	153,500
National Mortgage and Agency Company of New Zealand, Ltd. (Head Office, Dunedin)	Longburn ..	60	1,500	165,000
Wairarapa Frozen Meat Company, Ltd., Masterton ..	Waingawa ..	250	6,000	270,000
Gear Meat Preserving and Freezing Company of New Zealand, Ltd., Wellington	Petone ..	100	10,000	300,000
New Zealand Bacon and Meat Packing Company, Ltd., Wellington	Ngahauranga ..	120	3,000	120,000
Wellington Meat Export Company, Ltd., Wellington ..	Ngahauranga ..	120	8,000	240,000
,, ,, ,, ..	Kakariki* ..	100	2,000	90,000
Marlborough and Nelson.				
New Zealand Refrigerating Company, Ltd., Christchurch	Picton ..	30	2,000	30,000
Nelson Freezing Company, Ltd., Nelson	Stoke ..	30	500	50,000
Canterbury.				
Canterbury Frozen Meat and Dairy Produce Export Company, Ltd., Christchurch	Belfast ..	120	7,000	252,000
Ditto	Fairfield ..	..	4,000	100,000
,, ...	Pareora ..	25	4,500	233,000
New Zealand Refrigerating Company, Ltd., Christchurch	Islington ..	50	7,000	375,000
,, ,, ,,	Smithfield ..	50	6,000	304,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Kaiapoi ..	70	4,000	222,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch ..	Belfast ..	..	5,000	105,000
Otago.				
Waitaki Farmers' Freezing Company, Ltd., Oamaru ..	Pukeuri ..	..	3,500	230,000
New Zealand Refrigerating Company, Ltd., Christchurch	Burnside ..	50	3,500	216,000
South Otago Freezing Company, Ltd., Balclutha ..	Finegand ..	50	2,500	175,000
Southland.				
Ocean Beach Freezing-works (J. G. Ward and Co., Ltd., Managing Agents), Invercargill	Ocean Beach ..	100	2,500	110,000
Southland Frozen Meat and Produce Export Company, Ltd., Invercargill	Mataura ..	50	2,000	104,000
Ditto	Makarewa ..	120	2,000	75,000
,, ...	Bluff ..	..	..	114,000
Totals	..	4,345	145,900	6,962,500

* Not operating season 1923–24.